THE RAILWAY REVIEW

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Carefullness Pays.—Did you ever see a geologist pick up a mineral? He handles it with the daintiness of a connoisseur who holds a bit of Venetian glass. Why? Simply because it lies within the power of the moisture of the hand to soil the mineral. Everything can be spoiled by careless handling, and one of the most sensitive is lumber. It is not a rash statement to make that many thousands of dollars are lost every year by the deterioration of lumber due to careless piling. Don't think that because it is easier that it is cheaper to be careless in lumber piling. It seems to be inherent in the natural order of things to go wrong, perhaps because there are so many more wrong ways than right. But if you are not careful in the piling of your lumber you may be very sure that it will not be straight when you come to use it. Take car sills for an awful example. Suppose the supports at the ends are not parallel. Just a little out; laid on the ground. Well, out of parallelism means a twist in the stick, and a twist in the stick means that it will not dress to size, and not dressing to size means a loss of strength, and the story of the horseshoe nail repeated. Not much loss? Let's see. The sill should be 5x8 inches. The supports were not parallel; it dried with a twist and dresses 4⅛x7½ inches. Not much out? Let's see again: 5x8x8=320 and 4½x7½x7½=253⅛. Now, as 320 is to 253⅛ so is the strength of the full sized stick to that of the undersized, or the weaker has lost a trifle more than 22 per cent in the dressing. Not much? Well, isn't it enough to make it worth while to see to it that those supports are somewhere near to being parallel?—J. H. Allen in Dixie.

A Chinese Pile Driver.—Piles were being driven in one of the new buildings for a foundation for a punch. They were 8 inches in diameter and 14 feet long. The staging was bamboo, and so was the frame for the hammer, which was a round piece of cast iron with a hole in the center for a guide rod. Attached to the hammer block were twenty-seven ropes, carried up to the top of the frame and down on the outside, looking very much like the old fashioned Maypole. Twenty-seven women had hold of the ends, and with a sing-song, all together, pulled down; up the rod, four feet, traveled the hammer; then, at a scream, all let go, and down it came on top the pile, which was unprotected by a band or ring. The women were paid 20 cents in gold per day. This Maypole driver is in general use throughout Japan and China.—Cassier's Magazine.

Still Need for an Ark.—The great historic deluge was the first and last of its kind, but other dangers and disasters of which it was a type still need a Noah. still demand an ark, and still meet with the old time boycotter. One has not to go around the world to see this for himself. Men and women in all conditions of life, high and low, rich and poor, are everywhere to be seen in the great, sad but never ceasing drift of human wrecks. Count if you can the lost souls in the limit of your own township or memory that are drifting to shame, destruction and the devil. The man who once was honest but now is not; the man who once loved his home, and placed in the hand of her who mended his shirt and darned his stockings his weekly wage, who prided himself in his children, and they in turn were proud of him—but now in the year 1896 has his garden gate hanging on one hinge, his children in squalor and his wife in rags. You know the man who once was pure and manly in all he said and did, but now is nothing but a lump of carrion in body, soul and spirit; the man with gifts and talents that might have made him a king among men, but who now is but a bummer with inflamed cuticle and poisoned blood. You know the man who for sordid aims sold his soul, and in unnatural and vicious craving for wealth has lost all reverence for God or love for man, sees no beauty in nature, finds no delight in the smile of a child, and is in fact but a withered pea in a gold pod. In a broader, but less elaborate or personal sense we see bodies of men who refuse the gangway to the ark in their social and industrial troubles. They prefer a cock pit of strife to a board of arbitration, and the qualities of a bull dog to the virtues of a man. The same may be said of nations with the lust of a leopard for blood, and as much contempt for an appeal to reason and good sense as a Congo barbarian would have for a decision of the supreme court. And so it goes in the days of Cleveland as in those of Noah, that men boycott the ark, till it is out of their reach—and outside its closed doors the deluge and the fool.—[Fred Woodrow in Age of Steel.

A Lesson in Silver from Japan.—A writer to the Evening Post calls attention to an object lesson to be had out of the experience of the Japanese in free silver coinage, which he finds very effective in the state of California in clearing up the doubts of workingmen on the coinage question. The Japanese yen contains 374.75 grains of silver. the American dollar contains 371.25. The Japanese ten dollar gold piece contains 231.40 grains of pure gold while the American ten dollar gold piece contains 232.2 grains. The weights, therefore, are quite alike. Japan legally keeps the 16 to 1 ratio. If however you enter any one of the exchange shops in Tokia, Yokohama, Kobe or Nagasaki, and hand over a ten dollar Japanese gold piece or an American ten dollar gold piece the dealer will return to you without hesitation, and as a matter of business, not ten silver dollars but $19.50 in silver. If you hand him ten silver dollars and ask for gold, he returns you about $5.00 in gold. In spite of the ratio of 16 to 1 established by law, the dealing is put entirely on the commercial ratio and no one disputes it. The Japanese who use foreign products see the difference when they are compelled to pay 60 cents per pound for coffee and 75 cents per pound for American butter. Many industrious and honest workmen believe that a government has the power to and can control the ratio between the metals. But when they clearly comprehend that the great Japanese nation cannot do it, it opens their eyes. Moreover, Japan is almost entirely independent of foreign nations, so far as imports are concerned. The people live on the home markets, and export much more than they import.

Safety Appliances in Australia.—The annual report of the Railway Commissioners of the New South Wales Government Railways and Tramways for 1895-'96 shows the following figures giving the number of miles worked under the absolute block system and also the number and percentage of places where interlocking of switches and signals has and has not been applied.

Date to end of	Number of miles of Line open for Traffic				Number of miles of Line on which the Traffic is worked under Absolute Block System.			No. and p. c. of laces which have or have not Points and Signals Interlocked		
	Quadruple	Double	Single	Total	Quadruple and Double	Single	Total	Interl'k'd	Not Inter	Total
October, 1888		71½	2,042½	2,114	28		28	104	318	422
July, 1891....		124	2,058½	2,182½	118¾	207½	326¼	234	262	496
July, 1893....	8½	149⅜	2,193	2,351	154½	910½	1065	294	237	531
July, 1896....	8½	154½	2,368¼	2,531⅛	159½	991	1150½	376	215	591

The report with reference to the equipment of trains with continuous air brakes shows that 1,623 vehicles have been fitted with the Westinghouse quick acting freight brake which brings the total number of sets of freight brake now in use to 6,223. The commissioners say: "We are pleased to state that the year has been entirely free from any passenger train accident."

The First Hydraulic Crane.—Sir Wemyss Reid, in the Nineteenth Century gives some reminiscenses of New-Castle-on-Tyne. One of the most interesting refers to the origin of the hydraulic crane. "As a youth," he says, "I remember a plain house in Westgate street, upon the door of which was a worn brass plate bearing the words, 'Mr. Armstrong, Solicitor'. The Mr. Armstrong of 40 years ago was an eminently respectable member of his profession. Some good people it is true shook their heads when they heard that instead of attending to conveyances and writs and mortgages he had taken to dabbling in mechanics. Not that way does fortune lie in the profession of law. But one day I was taken as a boy to see a remarkable new toy—it seemed nothing more—that had been placed upon the Quayside at Newcastle, where a few small steamers and Dutch merchantmen were in the habit of coming with cargo. It looked like a metal box with some curious handles, not unlike water taps, upon the lid. A good natured workman turned one of these handles, and lo! as he did so, a great crane hard by rattled its chain, and slowly but surely swung a heavy load into the air. It was like magic. 'Now try it yourself', said the man, as he stopped the movement of the crane. Timidly I moved the handle, and straightway the miracle was repeated. At the touch of a child the heavy load was at once borne upwards. 'It's all dunne by watter' said the man, 'and it's Armstrong, the solicitor, in Westgate street that's invented it.' That was the first hydraulic crane. 'Mr. Armstrong, solicitor' had found his true calling in life. He still kept up the practice of his profession. But he bought a small bit of ground by the side of the Tyne, away from the town, on the Scotswood road, and there he raised a modest building, within which the manufacture of his new hydraulic machinery was undertaken. From that humble beginning of more than forty years ago has sprung the vast Elswick establishment, which knows only one rival in Europe. Fifteen thousand workmen are busy from day to day at furnace, forge and lathe. Of course the place had begun to make great strides forward before I left Newcastle in 1862. The famous rifled gun had been invented and was becoming almost as important an article of manufacture as the hydraulic cranes and rams. But since then the development of the establishment has been almost appalling, and I could not recognize the scene once so familiar. It is 'Mr. Armstrong, solicitor,' now Lord Armstrong, who has given the impetus to the industrial progress of the Tyne."

The Value of Sunlight.—In his address as president of the Chemistry and Engineering Section at the recent meeting in Glasgow of the British Institute of Public Health, Prof. William Ramsay, explained how the violet rays of sunlight act upon moist organic matter, producing hydrogen peroxide; how this peroxide becomes water, and hands on the remaining portion of oxygen to the organic matter, which it thus destroys or changes. Now, these changes are destructive to the life of minute organisms, such as bacteria in sewage, and the germs of many, perhaps all, zymotic diseases, such as typhus and anthrax. These are the conclusions to be gathered from the recent work of Prof. Marshall Ward, Dr. Arthur Richardson and Dr. E. Frankland. We must have sunlight. In our rapidly growing cities its admission is a necessity for the commonweal, its exclusion a crime. But hitherto the conditions of city life, in England at least, have tended more and more towards the exclusion of sunlight. The smoke that goes up not only from our factories, but from every private house, that stretches over London like a veil even on the clearest summer Sunday, this not merely acts directly as a screen against the sun, but condenses around its particles the vapor of the atmosphere, forming mist peasoup fogs, and rainclouds, all which shut out off from us just those violet rays that we need for the destruction of the rapidly increasing bacteria. Prof. Ramsay, speaking in the smoke-vomiting city of the north, urged the same remedies as have been urged by all who have thought on this subject; first, more stringent enforcement of the smokey chimney act, and of municipal by-laws against smoke; secondly, the adoption of smokeless fuel, such as coke or coal gas.

Electric Traction—N. Y. N. H. & H. R. R.—The electrical equipment on the New York, New Haven & Hartford Railroad near Boston has frequently been referred to in these columns. The results of the experiments which have been made are reported to be entirely satisfactory, and it is stated by the Boston Transcript that this company has decided to make extensions of the service next season, and that as early as it can be done the Dedham branch will be equipped with electric trains to be operated on the third rail system. The work on this line, however, cannot be done until the raising of the second tracks of the New York, New Haven & Hartford Railroad is finished, and this will not be completed before the middle of next summer. The third-rail system, which has already been extended from Nantasket Junction to East Weymouth, will be extended toward Boston, and possibly by the end of next season trains will be running from the Old Colony station to Nantasket by electric power. The handling of the enormous suburban traffic of the road, it is believed, will be solved by this electric system, allowing the company to run cars more frequently and at less cost than at present. If the expectations of some of the officials of the New York, New Haven & Hartford road are fully realized, by the time the New Union station is completed, the road will have its suburban lines equipped for the running of electric cars. It will then be possible to establish a circuit similar to that of the Boston & Albany by double tracking parts of the branch lines. If the New York & New England lines are included in the scheme, it will be possible to establish two or three circuits of different lengths. The cars may not run all the way around on the branch lines, but complete the circuit by going back and forth between the lines of double track. One official of the road says that it will be easy to establish a connection between the Nantasket line, when that is extended into the city, and the Readville line, so that a circuit would take in the stations of Roxbury, Heath, Boylston, Jamaica Plain, Forest Hills, Clarendon Hills, Hyde Park, Readville, Mattapan, Milton Lower Mills, Granite Bridge, Neponset, Pope's Hill, Harrison Square, Savin Hill, Crescent avenue and South Boston. Just what extensions will be made, however, the company has not yet decided. The only point settled is that the third rail system has demonstrated its value and economy, and it has been decided to extend the system as rapidly as possible. When the system is extended, there will be a great many more trains run than at present, but the trains will be smaller and lighter with a corresponding saving of power. There is sufficient power at the electric station of the road near Hingham to run cars over a considerably longer line than at present used, and when the new system is applied to other lines there will probably be another power station located near Forest Hills. The New York, New Haven & Hartford has recently bought a considerable tract of land in the vicinity of Forest Hills, and while the object of the purchase is said to be to give the company storage room for cars, and additional trackage, it is not unlikely that the new power station will be situated on or near this site.

Continuous Brakes in Great Britain.—In an article by Mr. Clement E. Stretton, entitled "Continuous Brakes," which recently appeared in an English contemporary, comment is made upon the returns of the Board of Trade, relating to this subject, for the half year ending December 31, 1895, from which this writer had compiled tables and summarized the failures of brake apparatus as follows: "The facts very clearly show which is the best and safest form of brake. The Westinghouse brake never once failed to act or to stop the train. On the other hand, the automatic vacuum had six serious failures to act, and in consequence loaded passenger trains overran stations as follows: Failed at Newark, G. N.; failed at Holloway, G. N.; failed at Hemsworth, G. N.; failed at Purton, G. W. failed at Middleton, L. and Y.; failed at Wellington, S. E. Fortunately, in each case the line was clear, or serious accidents would have resulted. As to the faults of brakes, 510 cases are recorded. Under Class No. 1 no case took place. Under Class No. 2 the vacuum brake is recorded as "failing to act" on six occasions, and the Westinghouse on no occasion. Class 3 shows delays and and faults, not being failures, and it is interesting to observe the parts which cause the various troubles. The Glasgow & Southwestern Co. reports a fault of a vacuum 'triple' valve; most probably they intend to refer to a 'ball' valve.

THE ELECTRIC TRAIN STAFF.

A paper upon the subject of "The Electric Train Staff System" was read by Mr. Charles Hansel, M. Am. Soc. C. E., before the American Society of Railroad Superintendents at the convention which was held at Niagara Falls, September 9, 1896. For a detailed explanation of the Webb & Thompson permissive train staff system reference may be made to the paper by Mr. C. A. Goodnow, of the C., M. & St. P. Ry., before the Western Railway Club, which was summarized in THE RAILWAY REVIEW, of April 13, 1895. An abstract of Mr. Hansel's paper is given herewith.

The perfect block system may be described as a series of fixed signals located so as to divide the track into sections or blocks. The signals should be operated and controlled in such a manner as to make it impossible for the operator in charge of same to clear the controling signal and admit a second train into the section ahead while that section is occupied by a train or any portion of a train; in other words, such a system as will give to the engineer indisputable information that when the signal controling the section in front of him is in clear position he may proceed to the next controling signal with assurance that he will not meet a train or any portion of a train in that section.

The use of the electric train staff in England, India and Australia and to a limited extent in the United States has demonstrated beyond peradventure that it has passed the experimental stage and has now become an important and economic factor in safe operation of single track railroads. The practice in the United States of handling heavy freight trains at high speed has made it necessary to modify and improve the apparatus as first designed by Webb & Thompson so that trains may pass through block stations equipped with the train staff at any rate of speed desired, and we believe that we have now so perfected and improved the staff system as to make it cover all the points desired in a perfect block system without the use of the rail circuit and without any of the delicate electrical mechanism which accompanies the lock and block or automatic system.

OPERATED WITHOUT SEMAPHORE SIGNAL.

In order to control a section or block it is necessary to locate and operate one of these instruments at each end of the section, and for the purpose of describing the operation of this system we will assume that there is an instrument at each end of a section which will be referred to as "A" and "X."

These instruments will be connected with two ordinary line wires and will be operated and controlled by a line battery and a local battery at each instrument. The line battery of course, will vary as the length of line between the instruments. For ordinary blocks of from four to five miles it would require about 18 cells of open circuit battery for the line battery and from 8 to 10 cells for the local battery.

The instrument may be provided with as many staffs as is desired and this will be determined by the number of trains which pass in one direction, say from "A" to "X," before any trains are run through from "X" to "A." It is found that fifteen staffs are sufficient for ordinary traffic. The staff takes the place of the ordinary telegraphic train order and with the use of this staff we may abolish the telegraphic train order system, for it will be seen that two staffs cannot be taken out for the same section at the same time unless the permissive feature is applied.

When a train is ready to move from "A" to "X" the operator at "A" presses down the lever, sounding one bell at "X," which is for the purpose of calling the attention of the operator at "X" to the fact that "A" desires to send a train forward The operator at "X" acknowledges the call by pressing the lever on his instrument, sounding a bell in the tower at "A." The operator at "A" then asks permission from "X" to withdraw staff by pressing down the lever three times, giving three rings on the bell at 'X," and immediately turns his right hand pointer to the left, leaving it in the horizontal position pointing to the words "For Staff," indicating that he desires operator at "X" to release his instrument so that he can take a staff or train order from it. If there is no train or any portion of a train between "A" and "X" the holding down of the lever at "X" closes the circuit in the lock magnets at "A" which enables the operator at "A" to withdraw a staff. As soon as this staff is removed from "A," "A" turns the left hand pointer to the words "Staff Out," and in removing this staff from the instrument "A" the galvanometer needle vibrates, indicating to the operator at "X" that "A" has withdrawn his staff. "X" then releases the lever which he has held down in order that "A" might withdraw a staff and turns his left hand indicator to "Staff Out," and with this position of the instruments a staff cannot be withdrawn from either one.

The first method of delivering this staff to the engineer as a train order was to place it in a staff crane, which was located on the platform outside of the block station in the manner shown in Fig. 1. With the staff in this position it has been found in actual practice that the engineer can pick it up while the train is running at a speed of 30 miles per hour. A second staff cannot be removed from "A" nor a staff removed from "X" until this staff which was taken by the engineer in going from "A" to "X" is placed in the staff instrument at "X"; consequently the delivering of a staff from "A" to the engineer gives him absolute control of the section between "A" and "X."

This train order staff also controls all switches leading from the main line between "A" and "X," for with the style of switch stand which we have designed for the purpose the trainman cannot open the switch until he has secured the staff from the engineer and inserted it in the switch stand, and as soon as he throws the switch lever and opens the switch he fastens the staff in the switch stand and it cannot be removed until the switchman has closed and locked the switch for the main line. When this is done he may remove the train staff and return it to the engineer. It will thus be seen that this train order, in the shape of a staff, gives the engineer absolute control over the section and also insures that all switches from the main line are set properly before he can deliver the train staff to the instrument at "X."

In order that the operator at "X" may be assured that the entire train has passed his station we may divide the staff in two and deliver one half to the engineer and the other half to the trainman on the caboose or rear end of train and it will be necessary for the operator at "X" to have the two halves so that he may complete the staff in order to insert it into the staff instrument at "X" as it is impossible to insert a portion of the staff; it must be entirely complete before it can be returned to the staff instrument. This divided staff is shown in Fig. 1 between the staff crane and the staff instrument, the complete staff being shown to the left or next to the staff instrument. While the dividing of the staff into two parts so as to insure the passage of the entire train through a block before a second train can be given orders is a decided improvement over the original system, we have to offer a still further improvement which enables us to provide the same measure of safety without carrying the entire staff from station to station.

There are five rings on the complete staff. These rings are made of brass brazed onto the steel pipe which forms the body of the staff, and since it is necessary that all these five rings be on the staff in a certain position before same can be placed in the instrument it is apparent that if we remove one or more of these rings the staff becomes inoperative, and we have so designed the new model as to enable us to remove two of the rings. These rings are handed one to the engineer, the other to the trainman on the caboose and are carried to the next station ahead and delivered to that station in the same manner as the entire train staff is delivered, as described hereinbefore. The operator at each station has a certain number of these staffs with

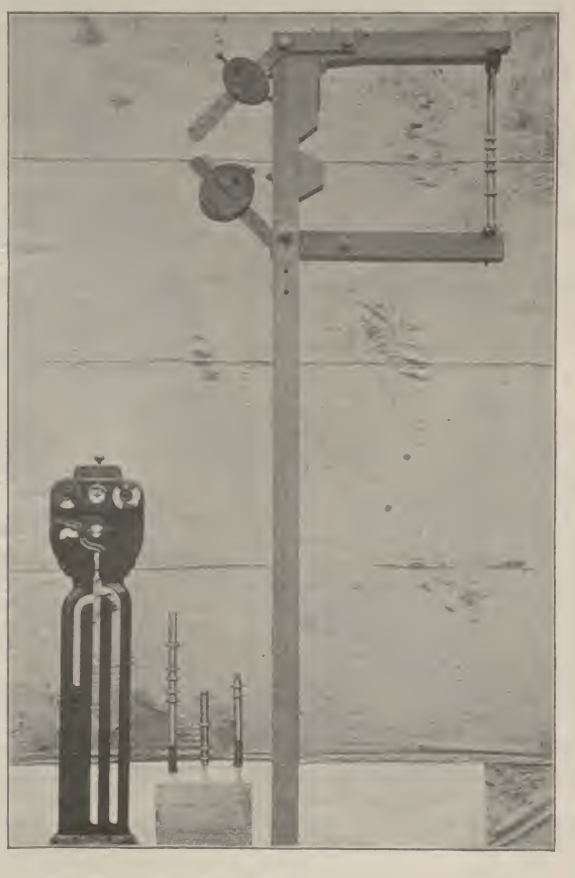


FIG. 1.

two rings missing, and before he can insert them in the pillar he will have to receive the two rings from the train and must place them upon the staff to make it complete before he can insert it in the instrument in order to release another staff from "A" or "X." The original staff weighs 2¾ lbs. and each ring weighs 2¼ ounces, so that it will be seen that we have reduced the weight of the staff or train order from 2¾ lbs. to 2¼ ounces, which enables us to provide a mechanism for picking it up at high speed with greater ease than if the entire staff was to be received and delivered.

OPERATED IN CONNECTION WITH SEMAPHORE SIGNALS.

In order to facilitate traffic it is essential that the engineer receives advance notice as to whether he will find a staff at the station toward which he is going; in other words, whether he will receive orders or be permitted to pass under a clear signal at high speed, and since the staff itself is not sufficiently large to be visible at a great distance it is desirable that the staff system be used in connection with semaphore signals. In order that the operator may be controlled in moving the levers which actuate these signals we have introduced the staff and lever locking shown in Fig. 2. This apparatus consists of a cast iron box fitted on the top plate of the regular interlocking machine. The mechanism contained in the box consists of a mechanical lock which can only be operated by the introduction of a staff as a key and when the staff is used as a key to release the signal lever it can be taken out as soon as it has performed that office and placed in a position to be received by the engineer, but unless the operator has unlocked the signal lever with this staff he cannot clear his signal. The act of releasing the signal lever opens the line wire between the staff instruments at "A" and "X," the purpose of this being to compel the operator to return the signal to the normal position immediately after a train has entered the block and with the lever in this position it is automatically locked and the line circuit is again renewed and the lever is locked in the normal position until he again has authority to clear it by receiving a staff release from "X."

We may secure this same result and insure that the signal be held at danger until the train has passed entirely through the block between "A" and "X" by an automatic system so that the control of the signal is taken out of the operator's hands simply by the acceptance of the staff by the engineer.

SIGNAL CONTROLLED ELECTRICALLY BY TRAIN STAFF.

Fig. 3 shows the regular semaphore signal at danger. Between the blade grip and the balance lever is located an electric slot so designed that when the magnets are deenergized the connection between the blade grip and the balance lever is broken and no matter how often the operator may attempt to clear this signal by moving his signal lever he cannot lower the arm as he has no connection with it. On the right of this semaphore is shown the staff crane which is designed on a similar plan to the ordinary mail crane. The two arms of this staff crane are connected with the electric slot on the semaphore signal by insulated wire, the circuit being run through a local battery, and so long as the staff crane is in the position shown in Fig. 3 the circuit is broken, the electric slot deenergized and the signal cannot be cleared. When the operator at "A" has withdrawn a staff from his instrument and removed a ring he places this ring on an auxiliary steel ring and engages it in the two arms of the staff

FIG. 2.

crane by bringing them to a horizontal position and slipping the auxiliary ring between the knife contacts on the end of each arm. The placing of this auxiliary ring in this manner completes the circuit through the local battery and the magnets of the electric slot, which at the same time completes the connection between the signal blade and the signal lever and the operator can now clear the signal. This position of the signal and train staff, or the ring which now takes the place of the staff, is shown in Fig. 4.

The auxiliary ring is made to facilitate the receiving and delivering of train staff ring from a moving train. The hook which is shown with the point about to enter the ring is located on the locomotive in such manner as to automatically engage with the ring when locomotive passes that point, so that the only duty put upon the engineer is to bring the hook to the horizontal position by depressing the handle of the lever, and as soon as the ring is received he disengages it and places it on the tender in a position to be delivered automatically at the next station ahead. The devise to be used on the tender is similar to the staff crane; that is, it holds the ring so that is delivered

on the staff crane in the same manner as before described for receiving the ring. If it is desired to use two rings thereby insuring the passage of the entire train through the block it is only necessary to provide two cranes and the operation for receiving and delivering the train staff ring from the caboose is the same as before described for receiving and delivering from the locomotive. As soon as the hook on the locomotive engages the auxiliary ring and removes it from the staff crane the circuit is broken through the local battery and the magnets on electric slot

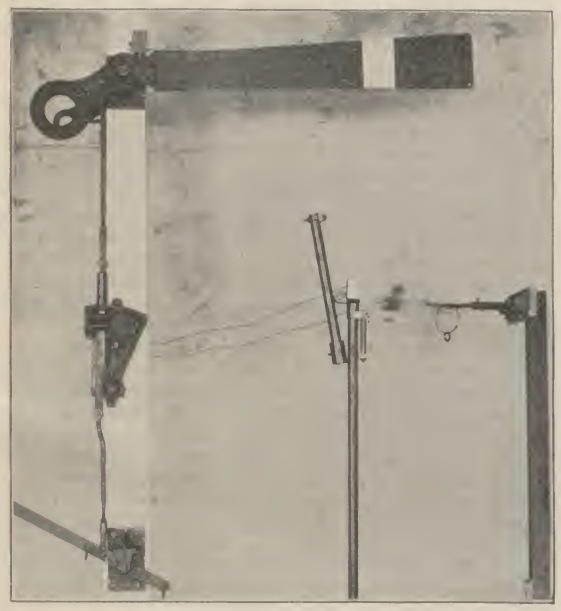


FIG. 3.

are deenergized, the arms of the crane and the semaphore arm fall to the position in Fig. 3 and the operator cannot clear the arm until the ring is placed upon the staff at the other end of the section, as before described. The ring is used in conection with the unlocking of switch stands in the block in the same manner as described for the full staff.

By the use of this special staff and the permissive attachment with tablets the system may be changed at will from absolute to permissive block. This permissive system has been used for some time by the Chicago, Milwaukee & St. Paul Railway, and Mr. A. C. Goodnow, assistant general superintendent, says in a letter referring to the operation of this system, "The train staff instruments are giving us entire satisfaction and we have operated

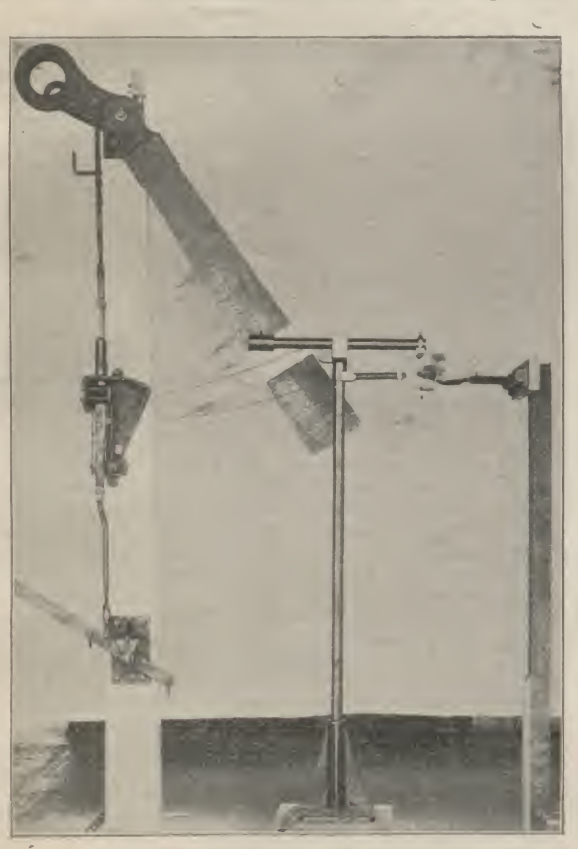


FIG. 4.

them from the moment they were put in service to the present without the slightest difficulty or hitch. For the past week or ten days traffic across the bridge has been extremely heavy, nearly thirty trains per day being handled. Traffic, owing to the congested condition of the yards on both sides of the river, was extremely irregular, and although the working of the staff instruments is such that in order to not delay passenger trains it is necessary to have the permissive staff and tablets at the right hand of the block, no difficulty was experienced on that account and no trains were delayed by staff working." While the movement of thirty trains a day does not express by any means the capacity of these instruments to facilitate traffic, an explanation of the conditions governing the operation of traffic at the point referred to by Mr. Goodnow may be of interest.

The instruments referred to govern traffic over one section of single track three miles long. This track is intersected by a grade crossing and draw-bridge necessitating two stops, as neither the crossing nor draw-bridge are operated and controlled by an interlocking system. Owing to the local conditions the speed of trains is limited and ten minutes is the allotment of time for passenger trains and fifteen minutes for freight trains over this section, and trains of each class are not permitted to clear the section in less time than that allotted, although they frequently are compelled to take more time by reason of the crossing and drawbridge. If the drawbridge and crossing did not intervene between these staff instruments it might appear that the number of trains mentioned by Mr. Goodnow was comparatively small, but in view of the time necessarily consumed on this section by reason of these physical obstructions to high speed and to other conditions it is evident that the officials of this railway believe that the movement of traffic over this section is facilitated and protected in a most satisfactory manner.

It has been demonstrated that by the use of this electric train staff system the volume of traffic over a single line may be greatly increased over the ordinary telegraphic train order system for the reason that as soon as a train has cleared a section and the staff has been delivered to the operator and introduced in the train staff instrument at the end of that section, a second train may be sent without the annoying delays often introduced by the telegraphic train order system, and it is apparent that the confusion and misreading of telegraphic train orders is absolutely avoided by the use of the electric train staff.

The apparatus described by Mr. Hansel is manufactured and installed by the National Switch & Signal Co., of Easton, Pa.

WHY RAILROAD MEN OPPOSE FREE SILVER.

The men employed in the general offices of the Pennsylvania Lines west of Pittsburgh recently paid a visit to the Hon. Wm. McKinley at his home in Canton.

Mr. McKinley was presented to the men by Mr. S. H. Church in an address which is worthy of reproduction and is here given.

Mr. McKinley:—When it was proposed among the employes of the general offices of the Pennsylvania Lines west of Pittsburgh that we come to Canton, the movement was enthusiastically promoted until, without any regard to party affiliations, we are almost unanimously before you—at least we are present nearly in the ratio of 99 to 1. There are no classes represented by us. Our railroad service knows nothing of artificial class distinctions. The highest officials who control the great corporations which we delight to serve, all began in the ranks. The brakeman of a few years ago has passed through regular grades of promotion to conductor, yardmaster, trainmaster, superintendent, and even to higher rank. The shopman and the engineman have developed into master mechanic and superintendent of motive power, and the surveyor's clerk of a few years back has reached the highest possible position. Every man before you knows that his advance in the service depends solely upon his own fitness, and the man who would appeal to us as a class against another class forgets the rule of life in this free country under which the intelligent workman of to-day becomes the manager to-morrow.

The Republican party is now engaged in a battle in which it seeks to rescue the public faith of this nation from the impending brand of public fraud. After winning many a hard fight it has enlarged the freedom and advanced the dignity of our people, and whenever it has been defeated, the growing prosperity of our country has been checked. The war of the Union itself was not more imperative than the strife for the public credit to day, for who would value national union without national honor? When the finances of the people are attacked the very heart and arteries of national life are put in jeopardy. Sir: it is the hope of my associates here to-day that the Republican party, under your splendid and experienced leadership, and aided by good men everywhere, shall win its fight so completely that no similar scheme of repudiation, bankruptcy and dishonor, debasing the currency to the common ruin of all, shall ever again be attempted in this generation.

There is a grave concern felt by every man in this assemblage for the preservation of his position in business and the welfare of his home. If this mad and cruel scheme of silver inflation should be inflicted on the people of this land, what would be its effect upon railroad interests? The very fear of it has caused an industrial inaction that is unparalleled, and a general shrinkage of railroad earnings of about 20 per cent, showing that confidence has been stricken down in every avenue of trade. The bonded debt alone on the railroads of America is more than $5,000,000,000, and the annual interest charge on this debt is about $250,000,000, the larger part of of which is payable in gold, and held by foreign creditors. Independent free coinage would very soon increase the annual interest charges on railroad bonds from $250,000,000 to $500,000,000, thus doubling the fixed charges of every railroad in America.

How will the railroads meet this vast additional tax upon their resources? Their only source of revenue is from transportation charges, and these are governed by congressional and state laws as well as by the laws of competition, and they cannot be advanced. The first step therefore which the railroads of the country must take, is to endeavor to hold the present share of business with a largely reduced force of men, and every man who can possibly be spared from his position, including those who have been crippled and are retained upon the rolls because of a humane regard for their condition, must be discharged. The wages of every man who remains will be reduced, and when he goes home the diminished salary will shrink in its purchasing power because it has been paid to him in cheap dollars. It is often said that corporations have no souls, but there are 40,000 employes on our lines west of Pittsburgh, and they all have souls which they fain would save from undue adversity.

The most unholy thing about this movement for silver inflation is the assertion that a debased currency is the money of the people, and that those who toil should be paid in cheap dollars. The truth is, and we who work for salaries know it as truth, that labor should be paid in the very dearest money which the government can issue, and that is gold, or silver and paper just as good as gold. The gold standard raises both silver and paper to a gold value and no man here today cares whether his wages are paid in gold, silver or paper. But with free silver coinage gold will disappear, and all other dollars will be worth only 50 cents.

Now, sir, the appeal to Americans to adopt a financial policy of their own without the aid or consent of any other nation, is a proposition that will command the support of the unthinking only. If we could erect a great wall around our boundless continent and never have account with the rest of the world, then our money balances would be exclusively among ourselves. But we aim at a higher destiny than that. With our inexhaustible material, and our sturdy and efficient labor, we mean to dominate the markets of the world.

Striving at such a destiny, are we independent of other nations? In 1891 the Argentine failures shook the Bank of England, and England sent home her American securities and sold them here for gold, and thus made the first drain on the gold reserve. When a crash in Argentine can drain our treasury are we independent in our commercial affairs? In 1893 the council of India voted to shut the mints of that country to the free coinage of silver. As quick as the cable could flash the news to London and New York the price of silver went down 25 per cent. When a few men on top of the Himalaya mountains can shrink the silver in our treasury vaults like that, can we make a declaration of commercial independence?

Sir, as a reader of books it has sometimes seemed to me that there was somewhat to be said in favor of international free trade, and I know that some of our brightest scholastic minds have been won to that theory. But when we throw away books and see the workmen in foreign lands busy making products which are sold in America, while our own workmen are idle and some of them in want for the necessaries of life, it comes to me in historic words, that it is a condition and not a theory that confronts us. Every American who can distinguish between condition and theory must inevitably strive for a wise and well adjusted system of protection, by which the republican party has already made this country the wonder of the world.

And so, sir, we have come here out of our abundant hope for the restoration of national prosperity in the promise of a sufficient tariff and the preservation of the gold standard of the civilized world, which will be our heritage when you are elected president and the flowing tide comes in.

It may be well to remember:

That there is not a free coinage country in the world to-day that is not on a silver basis.

There is not a gold standard country in the world to-day that does not use silver as money along with gold.

That there is not a silver standard country in the

rld to-day that uses any gold as money along with silver.

That there is not a silver standard country in the world to-day that has more than one-third as much money in circulation per capita as the United States.

That there is not a silver standard country in the world to-day where the laboring man receives as fair pay for his day's work, as he now does in the United States under the present gold standard.

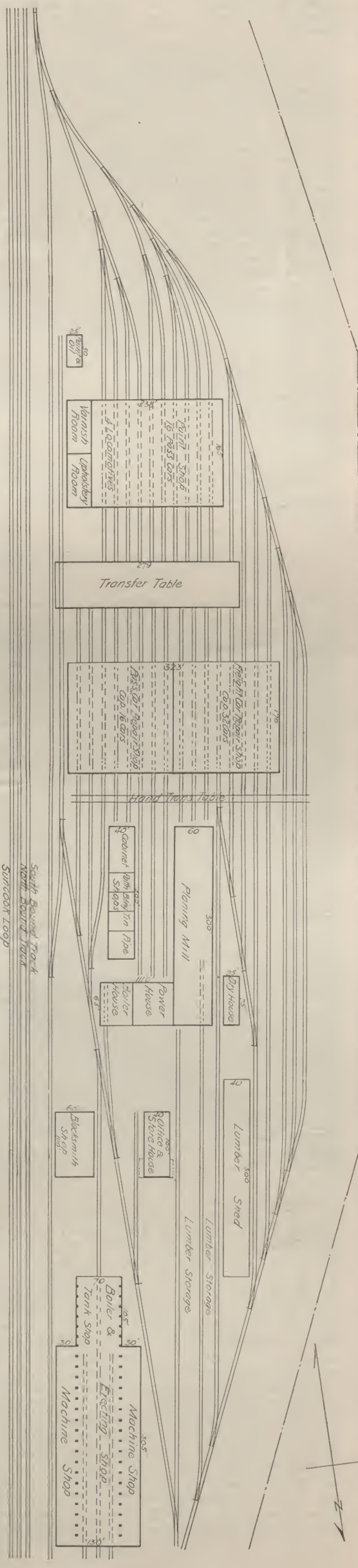
NEW SHOPS AT CONCORD, N. H.—B. & M. R. R.

A little more than a year ago what was formerly the Concord & Montreal Railroad became a portion of the Boston & Maine system, and since the assumption of control of the former road, the officers of the Boston & Maine have been enlarging the yards in Concord and preparing to erect a new shop plant. The work of construction has been started, some of the foundations having already been completed. A plan of the shops has been received from Mr. Henry Bartlett, superintendent of motive power of the Boston & Maine Railroad, from which the accompanying illustration was prepared. This illustration shows the arrangement of the shop yards and location of the buildings with reference to the main line which passes the property along the east side. There are three main tracks at this point, one for north, another for south bound trains, and a third for the Suncook Loop and from a fourth track lying upon the west side of these three, connections are made to the shop yard tracks. The arrangement is such as to give an additional connection to the middle of the plant. The locomotive work will be done in the large building at the north end of the plant, which is divided into three parts, the main building, 130x305 ft. being used as a machine and erecting shop. The building is divided by pillars, so that the erecting work may be done at the center, and the machine work be carried on at the sides of the same building. At the south end of this large building, a 105x70 ft. extension is for the boiler and tank shop. There is one track laid through this building from end to end, and upon each side of this an additional track is laid for the erecting work. The erecting and boiler shops will be equipped with two 30-ton overhead electric traveling cranes.

South of the locomotive shops are the blacksmith shop, which is 100x60 ft., and the office and storehouse 100x40 ft.; and this, by the way, is the only two-story building about the works. West of the three buildings mentioned is space for lumber storage which is divided into two parts and is served from three tracks, one of which enters the planing mill. West of the lumber yard is a lumber shed, 300 x40 ft., and west and south of this building are tracks for car repairs. The dry house, a building 25 x 75 ft: the planing mill, 300 x 60 ft. with a 111 x 65 ft. wing for the power and boiler houses and a 200x40 ft. building east of the planing mill; make a group south of buildings which have already been referred to. The last mentioned building of this group encloses a pipe shop, 39x38 ft.; a tin shop, a buffing and pattern shop, each 29x38 ft., and a cabinet shop, 70x38 ft., these shops being arranged in the order given, beginning at the north end, which brings the cabinet shop opposite and near the passenger car repair shop. The car repair shops occupy a building 323x 170 ft. which is divided by a central partition into a freight car repair shop, having a capacity of 32 cars, and a passenger car repair shop, with a capacity of 16 cars. Immediately north of these shops is a hand transfer table extending across the entire shopyard.

South of the car repair shops is a transfer table with a pit 279x70 ft., which will be operated by electricity. South of the transfer table is a building 238x165 ft., the west portion of which is used as a paint shop and has a capacity of 16 passenger cars and four locomotives. The east end of this building is divided into two rooms, 81x36 ft. each and used for varnish and upholstery work. The paint and oil storehouse is the extreme southerly building located near the paint shop and is 50x25 ft. in size. It will be noticed that considerable space is left between the transfer table and the car repair shops on one side and the paint shop on the other side, the distance between these buildings and the transfer table being 80 ft., which is sufficient for standing cars outside of the building and clear of the table on either side.

Electricity is to be used in several parts of this plant for power as well as for lighting. Beside the equipment of the erecting and boiler shops with overhead electric cranes and the transfer table with electric motors, there are several machines in different parts of the works which, on account of their isolated position, are adapted to be operated by electric motors, and will be so worked. The heating of the plant will be by the hot air system of the Boston Blower Company. One prominent feature in the layout of this plant is the location of the buildings in such a manner as to admit of extension of any or all of them without interfering with others or requiring changes in the works beyond a rearrangement of the tracks. This is a matter which is not always provided for, which accounts for the awkward arrangement of many extensions to old plants.



PLAN OF NEW SHOPS AT CONCORD, N. H.—BOSTON & MAINE RAILROA.

IS THE SWITCH AND LOCK MOVEMENT SAFE?*

To many this title may seem somewhat surprising, in view of the fact that almost every railroad is using switch and lock movements in one place or another, and that the signal companies install them, unless stated in the specifications that facing point locks shall be used. The switch and lock movement is used by a majority of the railroads of this country, while there are certain other roads which will use only the facing point lock, constituting a difference in practice, which is indeed surprising, considering the purpose of an interlocking and the dangerous nature of the apparatus if any part is incorrectly designed.

If the switch and lock movement is unsafe and facing point locks are the only safe devices for the purpose, why do the roads allow any of the former to remain in service, and why do signal companies countenance their being used? If they are safe why go to an additional expense of about 25 per cent of the cost of a plant for the sake of using a a facing point lock, not to speak of the additional cost of repairs, or the time lost in the operation of the plant moving additional levers? Does the facing point lock entirely overcome the objections to be made against the switch and lock movement, and are there no weak points in its design? If so, what is to be recommended as the best practice? Questions such as these show the necessity for a thorough discussion of the subject and the desirability of arriving at some definite expression of opinion on the part of the club. Upon signal engineers is laid the responsibility for the design and maintenance of these safety appliances, and if they are not safe, it is time that they should say so, in order that this responsibility may be placed with their superior officers.

The weak point in the design of the switch and lock movement is the short travel of the driving bar which is available for locking the switch or point after the movement of the switch has been made. With a total motion of 8¾ in. of the driving bar, but 2¼ in. at each end of the stroke can thus be utilized, the remainder, or 4¼ in., being used to turn the switch crank and with it the points of the switch. If, now, with a maximum locking travel of 2¼ in. the switch or point should be blocked and fail to close, as might easily happen through snow, ice, or any solid substance getting in between the point and the stock rail, the plunger would strike on the lock bar, and, if the connections were long or not in good condition, the lever could be pulled over, freeing the signal lever, and the switch would not be locked. More especially would this be likely to happen if two movements were placed on one lever when at any great distance from the tower, for not only is the power required for the two movements so close to what the connections will stand that the wear is very great, but the strain is such that it is hard for the operator to tell whether the plunger has entered the hole in the lock-bar and locked the switch or not. Of course where the connections are short and consequently stiffer, it is much more difficult, if not impossible, to spring the pipe the 2¼ in. necessary so that, to insure safety, these should be as short as possible. With this weak point about the movement, it is to be wondered at that any of them are to be found in use, and were it not for the protection afforded by the bolt lock, there can hardly be any doubt that they would all be taken out.

The bolt lock, however, is the key to the situation, for it puts a check upon the movement of the signal which no amount of plunger locking can give, and at the same time, takes no additional power to work it, and is of simple construction. No matter how loose the connections may be, or how much the lever may have been pulled over springing the pipe lines, unless the point has actually closed, the slot in the bolt lock has not come to its proper place and the signal cannot be cleared. If the signal cannot be cleared unless the point has been properly closed, safety is secured, as it is not intended that the track should be in condition for trains to run over it unless the signal is so cleared. Considering the switch and lock movement, when used in connection with the bolt lock, as being a reasonably safe appliance, the question might be asked, "What necessity is there for employing a facing point lock with the additional lever to pull and the extra cost?" Is there additional safety secured by its use sufficient to warrant the increased expense? To any one not well posted on signal matters it would seem that convincing answers to these questions might be easily made, in view of the fact that several roads specify or favor the use of facing point locks. But if there is reason for this the fact has not been made clear to several of us who would like to be enlightened.

With the facing point lock, the plunger has a travel of from 5 to 6 in. through the lock rod, so that should the switch fail to close, it would be practically impossible to get the lever over by springing the connections, and of course, the signal could not be cleared. This, at first sight, would appear as a much safer appliance than the switch and lock movement, but in re-

*A paper read before the Railway Signaling Club, September 22, 1896, by Mr. W. H. Elliott, signal engineer of the C., M. & St. P. Ry.

ality it is but little better, for if the connections to the switch should be broken or become disconnected in any way, and it is a fact that they do break occasionally, the plunger might enter the same hole in the lock-bar and lock the switch in the old position, allowing the signal to be cleared with the switch not changed. To guard against any such accident as this, a bolt lock must be used,and we are then relying upon the same means for safety as when using a switch and lock movement. If the bolt lock has to be depended upon to make the facing point lock safe, what need is there of the facing point lock when a switch and lock movement with one lever and one pipe line will answer?

It might be said that it is not possible to bolt-lock every switch or derail with the signal governing the route, which is true enough, and under such circumstances the advisability of using a facing point lock is not to be questioned, but even then some device should be used which would, by means of a spring, throw the points sufficiently to prevent the plunger from entering the same hole in the lock bar, should the connections fail in any way. Such a device was described by Mr. Miles in his paper read before the club in 1895.

When there are two switches to be connected which are 500 ft. or more from the tower, such, for instance, as a crossover, where both could be operated by one lever, but where, owing to the power required to work them at that distance two levers are required, it is much the better plan to make use of facing point locks, for not only is the cost less, but the switches are easier worked and are much less likely to be run through and damaged.

To sum up, the points I have endeavored to make are that it is best to use a switch and lock movement wherever a bolt lock can be put on the signal connection. If the bolt lock cannot be used and a facing point lock is to be put in, some spring device should be used to move the points slightly in case the switch should not have been moved by the lever and that no two switch and lock movements should be put on the same lever where they are more than 500 feet from the tower.

TWO NEW LOCOMOTIVES—BROOKS LOCOMOTIVE WORKS.

The accompanying illustrations were made from photographs recently received from the Brooks Locomotive Works of Dunkirk, N. Y. They show a ten-wheel, freight locomotive for the Chicago, Rock Island & Pacific Railway and a six-wheeled oil burning locomotive for the Congress Gold Company of Congress, A. T., which have recently been completed by those builders.

TEN-WHEELED FREIGHT LOCOMOTIVE.

This locomotive has 19½ x 26 in. cylinders, 57⅜ in. driving wheels and a 61 in. boiler. It is designed for bituminus coal and is to carry a boiler pressure of 180 lbs. The boiler has an extension wagon top with the dome forward of the fire-box. The boiler braces are of Ulster iron and the tubes are fitted with copper ferrules on the fire-box end. The fire-box is long and of the sloping type. The crown sheet is supported by radial stays with slings for the four front rows. The fire-box has a brick arch supported on three water tubes 3 in. in diameter and of No. 6 B. W. G. iron. The corners and sides of the fire-box, the bottom of the waist, the back head and sides of the boiler above the crown sheet are fitted with washout plugs. The safety valves two in number, are by the Ashton Valve Company both being of the 3 in. size, one muffled and one open. They are set at 180 and 182 lbs. The smoke-box which is of the extension type is separate from th e boiler and has a pressed steel front and door. The stack is jacketed according to the practice on the Chicago, Rock Island & Pacific Railway. The engine truck frame is of wrought iron with cast iron pedestals and the truck springs are from the Scott Spring Company. The guides are of the two bar type and the cross head is of the alligator form and of cast iron. The piston rod packing is Jerome metallic and the valve stem packing is furnished by the railway company The valve motion is of the usual Stevenson type with a short radius link and the other details of the motion are arranged to correspond. The links are of Low Moor iron. The driving and engine truck axles are of Cambria steel toughened by the Coffin process. The eccentric straps of the engine are of brass like those of the passenger locomotive recently built by the road and illustrated in the RAILWAY REVIEW of May 30, 1896.

The attachments of the engine include Westinghouse brakes, on tender and train and the American brakes on all the driving wheels. The Westinghouse train signal and Gollmar bell ringer are used and magnesia covering is applied to the boiler steam chest and dome. The tender is similar in style to the one illustrated in connection with the passenger locomotive already referred to. The trucks are the standard type for the road and are known as "L" trucks. They are fitted with the National Hollow brake beam, Fletcher box lids and vulcanized dust guards. The tender wheels are 33 in. in diameter a nd are of the chilled plate form. The engine truck wheels are 28 in. in diameter and are the McKee-Fuller steel tired spoke type. For convenience in comparison, the following table of details is given.

Cylinders	19½ x 26 in
Driving wheels	57⅜ in
Boiler	Extension wagon top
Diameter of waist	61 in
Waist sheets	9-16 in. and ⅝ in
Throat sheet	⅝ in
Front flue sheet	½ in
Longitudinal seams	Sextuple butt riveted
Rivets, diameter	1 in
Tubes, number of	296
Tubes, diameter of	2 in
Tubes, length of	13 ft. 1 in
Grate, length	108 in
Grate, width	32⅞ in
Grate, area	24.7 sq. ft
Water space, back and sides	3½ in
Water space, front	4 in
Stay bolts, spaced not over	4¼ in
Fire brick arch on 3 in. water tubes.	
Wheel base, rigid	6 ft 6 in
Wheel base, driving	12 ft. 4 in
Wheel base, engine	23 ft
Wheel base, total	47 ft. 6½ in

TEN-WHEEL FREIGHT LOCOMOTIVE—BROOKS LOCOMOTIVE WORKS

Weight on drivers	113,500 lbs
Weight on front truck	31,550 lbs
Weight of engine	145.050 lbs
Weight of tender	80,000 lbs
Guides, two bar, alligator cross head.	
Slide valve balanced, C., R. I. & P. Ry. pattern	
Driving wheels centers cast iron, diameter	51⅜ in
Tires, truck crucible steel thickness	3 in
Drivers, main and back pair, flanged width of tires	5¾ in
Drivers, front pair, plain, width of tires	6¼ in
Driving axle journals	8 x 10 in
Crank pins,	Coffin toughened steel
Cylinder lubricator	No. 9 Nathan
Injectors two	No. 10 Monitor, '88 pattern
Cab,	ash and pine
Pilot	oak
Tender frame	oak
Tender wheels, chilled plate	33 in
Tender journals	4¼ x 8½ in
Capacity of tank	4000 gal

SIX-WHEELED OIL BURNING LOCOMOTIVE.

This locomotive has a fire-box which is arranged for burning crude petroleum and has a combination eight-wheeled tender with a water capacity of 3,600 gal. and an oil capacity of five tons. The smoke-box is short and is fitted with deflector and no netting. The locomotive is furnished with the following attachments. The LeChatelier water brake, connected to the bottom of the exhaust passages; Westinghouse automatic brake for tender and train; American outside equalized brake for driving wheels; Westinghouse train signal; Cooke and Strong bell ringer; National brake beams; Janney new style M. C. B. coupler on both ends; tender truck wheels of the McKee-Fuller steel tired spoke type. The engine is also supplied with a Nathan fire extinguisher with 200 ft. of 2 in. hose and nozzle arranged under the running board. The oil burning devices were designed and patented by Mr. G. W. Prescott, who was formerly superintendent of motive power of the Southern California Railroad. The following table gives a summary of the chief dimensions:

Cylinders	17 x 24 in
Driving wheels, diameter	51 in
Boiler	Crown bar, wagon top
Waist, diameter	56 in
Working pressure	180 lbs
Throat sheet	⅝ in
Front flue sheet	½ in
Longitudinal seams	Quadruple riveted
Rivets	⅞ in. and 1 in
Tubes, number of,	226
Tubes, diam. of	2 in
Tubes, length of	11 ft. 1 in
Fire-box	Shallow
Grate, length	78 in
Grate, width	32 in
Grate, area	17.3 sq. ft
Water space, back and sides	3½ in
Water space, front	4 in
Stay-bolts, spaced not over	4¼ x 4⅛ in
Crown bars, double, welded at ends	5½ x ¾ in
Crown bars, spaced, center to center	5⅛ in
Crown bars, raised above crown sheet	3¼ in
Wheel base, rigid	11 ft
Wheel base, driving	11 ft
Wheel base, engine	11 ft
Wheel base, total	40 ft. 6 in
Weight on drivers	112,000 lbs
Weight of tender	86,000 lbs
Guides, two bar	wrought iron case hardened
Slide valve	balanced
Driving wheels, centers, cast iron, diam.	44 in
Tires, open hearth steel, thickness	3½ in
Driving wheels, front and back pair flanged width, of tires	6 in
Driving wheels, main, plain, width of tires	6½ in
Driving axles, hammered iron, journals	7½ x 9 in
Crank pins	Hammered steel
Cylinder lubricator	No. 9 Nathan
Injectors, right side	No. 7 Nathan
" left side	No. 8 Nathan
Cab	Ash and pine
Pilots, short form under bumpers	Oak
Tender frame	10 in. channel iron
Tender wheels, McKee-Fuller steel tired spoke diam.	33 in
Tender journals	4¼ x 8 in
Capacity of tank	Water, 3,600 gal
Capacity of tank	Oil, 5 tons

This engine has two sand boxes and uses Jerome metallic packing on piston rods and valve stems. The smoke-box is fitted with a deflector without netting. It has washout plugs in the corners and sides of the fire-box, the bottom of the waist, in the back head, and at the sides of the boiler above the crown sheet. The wheel covers are omitted. A blower attachment for the house is provided with a steam hose connecting with the smoke-box and burners.

OIL BURNING LOCOMOTIVE—BROOKS LOCOMOTIVE WORKS.

Engineers' Club of St. Louis.

The Engineers' Club, of St. Louis, held a regular meeting September 16, President Ockerson in the chair. A committee reported the establishment of a trust fund for the

entertainment of visiting engineers, and referred to the club the question of the best method of administering the trust. It was ordered that the fund be left in the hands of the executive committee to formulate a set of rules covering the matter, and to submit them to the club for approval.

A paper by W. J. Sherman on the Galveston Harbor Works was then read. The paper gave a description of what is one of the most extensive improvements ever undertaken by the United States government. The entrance to the harbor was impeded by a depth of only 12 ft. on the outer bar and 13 ft. on the inner. The first improvements attempted were by dredging, without favorable results. The gabionade system was then undertaken, at great expense. No improvement resulted. The third project consisted of jetties of brush and stone. This bid fair to succeed, when it was found that the brush work was being destroyed by the sea worm, known as the Teredo Navalis. The present scheme of two practically parallel solid rock jetties was then adopted and is now in progress of construction. It has already deepened the outer bar to 20 ft., and it is believed that in good time it will reach the desired depth of 30 ft., with the aid of dredging. The author gave the cost of the work, the rate of progress, and other interesting details.

Messrs. Crosby, Moore, Russell and Barth participated in the discussion.

AUTOMATIC BLOCK SIGNALING FOR SINGLE TRACKS.

A model of a system of automatic block signaling for single track lines was exhibited by the Union Switch & Signal Co., of Swissvale, Pa., at the convention of the American Society of Railroad Superintendents, which was held at Niagara Falls, New York, last week. The system is illustrated by the accompanying diagram, the explanation of which is reproduced from a circular issued by the manufacturers.

The importance of automatic signal protection is fast becoming recognized by all those interested in railroad management, and the introduction of signals on double track roads has become so general that their operation is familiar to many railroad men. The overlap system of signaling for single track roads however is of more recent origin, and, although quite as successful, has not become so well understood. In signaling by this system, the road is divided into blocks, the length of each being regulated by the traffic and natural conditions. At the beginning and end of these blocks signals are placed and these signals are so arranged as to show danger as long as there is a train, a car or engine, a broken rail or open switch within the block.

To better understand the protection this system provides, a few train movements will be explained. This diagram represents, in part, both a double and single track road equipped with electric signals and electric switch indicators. The function of these indicators shown at W, Y, X, Z4 and Z3, is to show the condition of the track in both directions from the switch to train men working at the switch. That is, should a train be within the block in which the switch is located, the indicator will show red, thus giving notice that it would be unsafe to open the switch. At each switch a circuit shifting device is placed called a switch box, which acts to set the signal to danger when the switch is opened.

A train moving from A to O, the track being unoccupied and all switches properly set, will find all signals clear. Signal No. 4 controling movement from right to left, however, will be red, as it is in part, controlled by the position of switch Z, and will show red while the switch is set for left to right movements. The movement of a train from A to O, and the operation of the signals and indicators will be as follows:

Entering A, the indicator Y is set to danger, thus giving warning, at the cross over, of the approach of a train. On entering B the indicator Y, is still held red, while signal No. 1 is set to danger, thus protecting rear of train. Leaving B the indicator Y is cleared, and on entering C indicator Z4 shows red. This indicator is only operative when switch Z is set for left to right running.

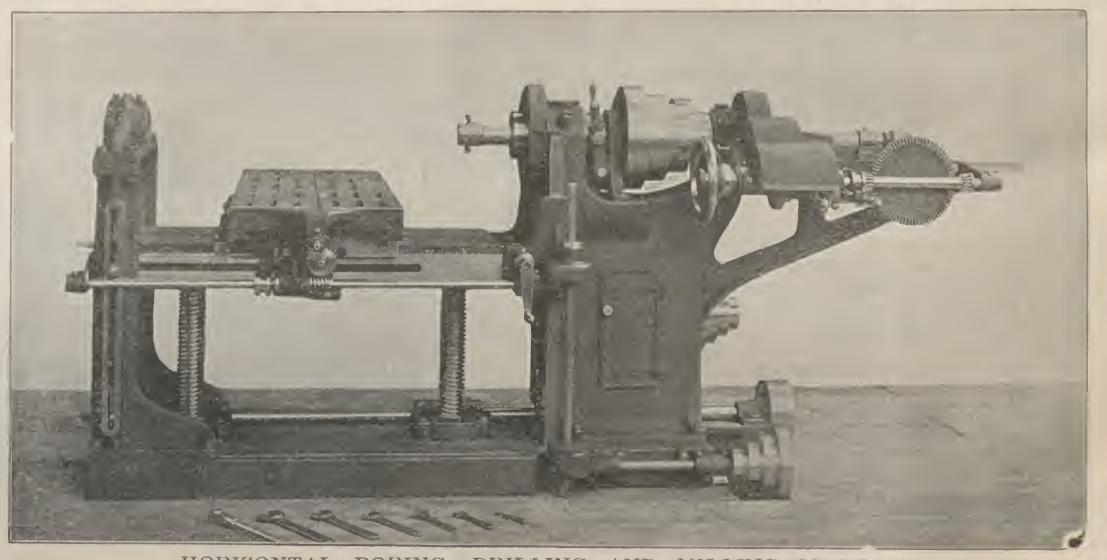
Entering D Signal No. 3 is set to danger as long as this section is occupied signal No. 1 remains red. Entering H, signal No. 1 and indicator Z4 are cleared while indicator Z3 is set to danger. Entering I sets signals Nos. 5 and 6, to danger. There is no change now until K is reached, when signal No. 3 and indicator Z3 are cleared. Entering L, sets signals No. 7 and 8 to danger. Entering M, signal No. 6 is cleared. Entering N, signal No. 5 is cleared. Entering O, Signal No. 7 remains at danger, while signal No. 8 is cleared. Leaving O, everything is restored in the normal position.

A right to left movement would be as follows: switch Z being set for the upper track, and signal No. 3 normally at danger. Train entering O sets signal No. 7 to danger; proceeding to N sets signal No. 8 to danger; thence to M sets signal No. 5 to danger; thence to L sets signal No. 6 to danger. On entering K, signals No. 7 and 8 are cleared, and at J indicator Z3 announces the approach of train from right to left, signal No. 3 being already set to danger by position of switch Z. Entering I it sets signal No. 4 to danger, and at H clears signals No 5 and 8 and continues to hold indicators Z3 at danger. At G, indicator Z3 is cleared and indicators X and W are set to danger. Entering F it sets signal No. 2 to danger, and still holds signal No. 4 red, while at E, signal No. 4 is cleared, but indicators X and W are still held red. Leaving E it clears signal No. 2 and indicators W and X.

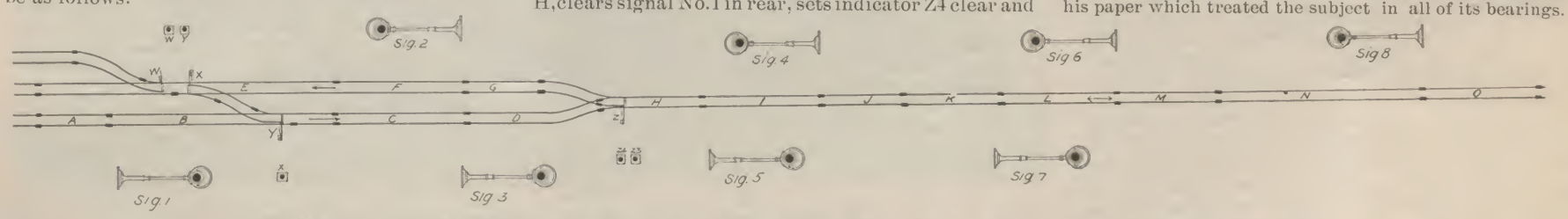
A car on fouling point of siding would set to danger signal No. 2 and indicators W and X; the siding switch being reversed the same danger signals would be displayed. In setting the crossover, indicators W, X and Y and signal No. 1 would protect the movement. A train moving from the siding to the main line of single track by way of switch Z is protected by signals No. 4 and 1, set to danger by movement of the switches, until it reaches C where it sets indicator Z4 to danger, and at D signal No. 3 is set to danger. When switches are set to their normal position all indicators are cleared except Z4, and signals then protect running as described in first movement. While a movement is being made from the main line to the upper track, a train from A would be stopped by signal No. 3 showing danger.

The following movements will show the protection afforded two trains traveling on the same track from opposite directions:

Train No. 1 on D, holds signals No. 3 and 1 at danger in rear and signal No. 4 and indicator Z4 ahead. Train No. 2 appoaching from O, on reaching N, will have signal No. 8 at danger in its rear and signals No. 7 and 5 in front. As train No. 1 is still in D, train No. 2 can proceed, and, on entering L will add signal No. 6 in its protection. Train No. 1 is entering H, clears signal No. 1 in rear, sets indicator Z4 clear and



HORIZONTAL BORING, DRILLING AND MILLING MACHINE.



AUTOMATIC BLOCK SIGNALING FOR SINGLE TRACK—THE UNION SWITCH & SIGNAL COMPANY.

HORIZONTAL BORING, DRILLING AND MILLING MACHINE.

The accompanying illustration is reproduced from a photograph of an exceedingly heavy boring machine manufactured by Bement, Miles & Co. of Philadelphia. This machine will drill or bore into the center of a 66 in. circle. The spindle is 2⅞ in. in diameter and has an extreme traverse of 40 inches. Two feeds are provided for drilling and two for boring, and the spindle may be rapidly moved by hand in either direction for making adjustments. All the feeds are automatic and may be instantly reversed or changed. The main table is about 435 ft. long and is raised and lowered by power by means of beveled gear wheels and screws. When desired a circular table with automatic or hand rotating gear is furnished. Screw cutting attachments are also provided on the machine when desired, and power is supplied through a four-step cone, the largest diameter of which is 15 in., and the driving belt is 3 in in width. Heavy back gearing is provided through which eight speeds may be obtained, the back gearing being thrown on and off instantly by means of a positive clutch. The machine shown herewith is known as the No. 1 size, and the design is manufactured in ten different sizes, ranging from this up to a machine which weighs about 100 tons. The Chicago office of this company is in the Marquette Building and the New York office at 39 Cortlandt street, at either of which places or at the home office in Philadelphia, further information regarding the machine may be obtained.

The Western Society of Engineers.

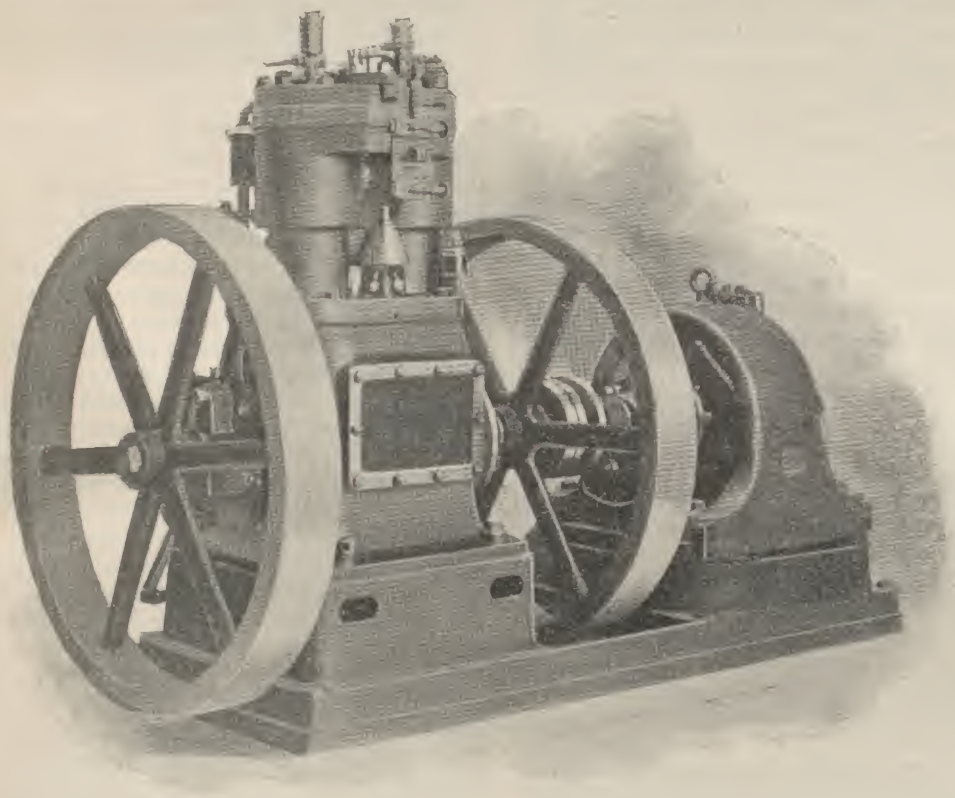
A regular meeting of the Western Society of Engineers was held Wednesday evening, September 16, Mr. John Lundie presiding. After the business was disposed of the papers of the evening on "Parks and Roads" by Messrs. H. C. Alexander of Lincoln Park, Chicago, and J. F. Foster of South Park, Chicago, were presented. Mr. Alexander gave a retrospective view of parks from a period in the early days of England and France, when the crowned heads beautified grounds for their own sole benefit and pleasure, the common people not being admitted, down to the evolution of universal freedom in the use of these adjuncts to health and happiness. He pointed out some of the many difficulties with which the engineer has to contend in his efforts to make these parks vie with unadorned nature.

Mr. Foster being unavoidably absent, the secretary read his paper which treated the subject in all of its bearings. In it was presented a compendium of details. Both papers were highly creditable to the authors and evinced a thorough familiarity with the needs and requirements of the purpose for which parks have been established. At the conclusion of the paper a discussion was held. Vice President Thomas T. Johnston presented a strong plea for the freedom of the parks as places of recreation and as important sanitary measures. He presented statistics which he had compiled in his connection with the drainage canal, giving evidences of the great beneficial influence of these breathing places upon the health of the city. He also suggested the establishing of large commodious bath houses in the parks to be supplied with water from artesian wells sunk to a depth of perhaps 2,000 ft., at which

point he claimed the temperature of the water would be from 80 to 100 deg., which would make the baths available throughout the year. These points were further discussed by others present. Roads, bicycle paths, the planting of trees, and other prominent features of pleasure and utility in park development received consideration. Among those taking part in the discussion were Messrs. Alexander, Maddock, Hill, Kellog, Davies and Bley. A unanimous vote of thanks was tendered Messrs. Alexander and Foster for their instructive and interesting papers.

THE WESTINGHOUSE GAS ENGINE.

It has been pretty generally understood for some time past that Mr. George Westinghouse has been working on a design for a gas engine which would be adapted for use in running electric dynamos, and as the designs of Mr. Westinghouse are usually of the practical kind and wear well the advent of this engine has been watched for with considerable interest. It seems that work on this design has been carried on in a quiet way for the past ten years and during the past two years has been pushed vigorously. A number of engines have been built varying in size from 5 to 200 horse power, and with these machines exhaustive tests have been carried on and the design of each detail has been perfected by subjecting it to regular and severe duty with the object of developing weak points. The fact that these tests have been so long continued and so carefully conducted gives the manufacturers of the machine good



THE WESTINGHOUSE GAS ENGINE.

and sufficient reason for claiming that they are not following the too common practice of expecting purchasers to develop the design. It is stated that in the work the whole field of invention in this line has been carefully reviewed, the best obtainable engineering talent being employed to produce an engine which should be a radical advance over all others.

The general appearance of the engine as coupled direct to a dynamo is shown in the accompanying illustration and from this it will be seen that it is of the upright type and somewhat similar in form to the Westinghouse steam engine. The base is of the box form and within it are encased the cranks and also all the valve actuating mechanism. The latter is usually considered the most delicate part of a gas engine and this construction gives complete protection of the valve gear from dust and dirt and, as the cranks run in oil, good lubrication is insured. The valves are all of the poppet type and are actuated positively. One of the greatest difficulties with the usual design of gas engines is that the speed is generally regulated by the number of impulses instead of by the force of the impulse, and with this condition some variation in the speed is unavoidable, particularly when working with light loads. The Westinghouse engine receives an impulse at every revolution, the speed being regulated by the quantity of explosive mixture delivered in each charge, and it is claimed that in smoothness of running and close regulation it will compare favorably with the best steam engines. The engine will use either gas or gasoline and the change can be made from one to the other while it is in motion. The new works of the Westinghouse Machine Co., where these machines are being built, have recently been completed at East Pittsburgh, Penn., and are beyond a doubt as complete and as fully equipped with modern machinery as any in existence.

THE MANUFACTURE OF WROUGHT IRON*

By MR. JAMES KERR.

The subject of the manufacture of wrought or malleable iron is not by any means a new one. The process has so often been written about and discussed that there is nothing new to be said. I propose, therefore, to describe the conditions of the puddler and the puddling process as they were twenty-five to thirty years ago and as they are to-day, dealing with practical work and economy. I may claim to speak with some authority on this department, for I was myself for eight years a puddler, and have been connected with the manufacture of wrought iron in all its forms since I was ten years of age.

Twenty-five to thirty years ago the puddling furnace was of a small single reverberatory type, with open grate and ashpit, and without steam jets or blowers as are now used. Every furnace was built to an exact gage, with a monkey, or piece of brick work projecting on the bridge to keep the flame off the back wall and cause it to curl round the stopper hole, the exact size of the flue, bridge and neck depending very much on how the fore-hand found it to work. Sometimes, but not always, an egg-end boiler was attached to every two furnaces. The fuel used was any cheap coal such as the local Kiltongue, and was sometimes very brassey. The regular charge was 4 cwt. 1 qr. 20 lb. or 4 cwt. short weight, and the output per shift of six heats was about 22 cwt. to 24 cwt., according to the quality of pig iron used. The consumption of fuel averaged about the same as the charge. Besides having to puddle his six heats, the puddler in those days had to break up 10 cwt. or 12 cwt. of "bull-dog" for fettling, besides 2 to 3 cwt. of "blue billy," and also wheel in any light iron he might require. Altogether it was usual to work thirteen to fourteen hours for six heats, and for a produce of 22 cwt. to 24 cwt. I might also mention that the common practice was to drag the puddled balls along the plates to the hammer, the fore-hand or under-hand swinging it on to the anvil, when it got one blow and was then turned up and got a second blow. It may be a surprise to most of you when I say it was a very common practice to compel the men to get six heats per shift before stopping, so that it was no uncommon thing toward the end of the week for the day shift puddler to commence work at 12 o'clock noon instead of 6 a. m., and on the Saturday finish at or near Sunday morning.

Puddling as carried on to-day is different. The furnace itself is not much altered—only a little larger; but the grate is entirely closed up, and dross (mostly washed) is used with forced blast either by steam jet or blower, the single furnace being used for steam raising by attaching a double flued Lancashire boiler. A cheaper and better fuel is thus used, and much less of it. The result of this is that puddlers now charge 5¼ cwt. to 5½ cwt. short weight, and work six heats easily in twelve hours. They do not now require to break "bull-dog," because it is not used. In its place superior fettlings are used—ball furnace tap, pottery mine, hematite ore, cinder tap reduced in a special furnace from scale, purple ore, etc. These being all much higher in iron, a less quantity is required, and the puddler gets them all delivered to him at the furnace. He does not now require to leave his furnace to go to the hammer and place the puddled ball on the anvil; by arrangement with the shingler the latter now does this. Puddling is considered by some a very laborious job, but it need not be so. Any intelligent man by the exercise of reason can lighten it considerably. Speaking from my own observation during the last twenty-five years, although iron manufacturers have been blamed for making no effort to improve either the process or the economy in working, I may say that during those years the produce of the puddling furnace has been increased by about 30 per cent for less working time, for a less amount of labor and expenditure of fuel, and also at a much less waste of iron by oxidation.

I will now explain the preparation of the furnace and the puddling of a heat of iron, using the terms employed by the puddler. To begin with, the furnace bottom is first prepared by oxidising light iron, the oxide acting as a protection to the bottom plates. Fettling, of the kinds I have already mentioned, is then placed around the sides, and the whole forms a hollow cavity not unlike a basin. From 56 to 84 lb. of hammer slag or roll scale is then thrown in, and the pig iron (generally a special mixture which from experiments has been found to give good results) is thrown round the bottom. The average analysis of a heat of pig iron may be taken as

Carbon, combined and free	3.93
Silicon	2.13
Phosphorus	1.40
Sulphur	.08
Iron (by difference)	92.41
	100.00

The pig iron is, of course, in half pigs, and it is at the melting stage that the puddler, by paying attention, can save himself a great deal of extra work and much loss to the manufacturer. If he is not careful to see that his iron is melted uniformly, but allows some of it to be exposed unduly to the fire, it drops at once on to the bottom, and melts the oxide off the plates. Supposing the heat is now uniformly melted, the hammer or roll scale floats on the top, and prevents it from being burned. The puddler is understood to have been working the iron from the time the pigs first commenced to melt, and he gradually increases the agitation as the iron becomes liquid.

It is now at a sufficiently high temperature, but he still continues the agitation, and when he thinks the iron is sufficiently heated he puts on a small fire, with the object of damping the furnace, and puts down the damper, thus lowering the temperature. Still he agitates till the metal becomes pasty with the lowering of the temperature, and when sufficiently thick the damper is raised, and the temperature again increased. At this stage the iron mixes with the cinder, and it is now on the boil, and appears for the first time in a semi-malleable form and in granular parts.

It is now boiling rapidly, and some impurities in the form of cinder flow over the fore plate of the furnace, owing to the increased bulk. It is now that the puddler requires to keep up the agitation, to prevent it from stick to the bottom and sides of the furnace. As it increases in temperature the cinder becomes thinner, the iron ceases to boil, and settles down, or, as the puddler says, "drops," and is then in a soft, spongy mass, and requires to be well and uniformly turned over and exposed to keep it at a regular heat all through. It is in this state that loss by oxidation may take place through exposure to cold air rushing through the stopper hole.

The puddler now balls it into four or five balls of a little over 1 cwt. each, and takes them one at a time to the hammer, where any cinder now in it is hammered out, and the balls are finished in square or flat slabs and sent to the forge rolls. They are then rolled into puddled bar. The further manufacture into finished iron is merely mechanical, and I do not propose to deal further with it, as every manager has his own method of piling, etc., to produce marketable bars, but will deal shortly with quality. Twelve or thirteen years ago, anyone who ventured to express an opinion that malleable iron was not doomed to be totally superseded by steel would have been laughed at. Experience has proved, however, that while iron has been superseded to a great extent for shipbuilding and other large structural work, it is still in demand for general blacksmith work, horse shoes, chain and cable iron, tubes, hoops, etc. Although steel has developed locally to an enormous extent, still, in this district, at the present moment, there is a greater output of malleable iron than there ever was.

Now that we know the worst in connection with steel regards its effect on the consumption of malleable iron, I think malleable iron works managers, by applying themselves to the subject, might raise the quality of iron and actually re-take some of the orders which are now taken in steel. I have an opinion, for instance, that an iron retaining all the good points of malleable iron, and more nearly approaching steel in strength, elasticity and homogeneity, would find a ready market. I think I am correct in assuming that a breaking strength of about 23 tons is considered as high as iron can go and still retain its good points, although I am aware that iron for a special local contract has been specified by the engineer and has been supplied at 24 tons tensile strength. I have been experimenting myself in this direction, and I propose to submit a sample of puddled bar iron. The pig iron used was Cleveland, and the lowest quality that is used, I think, in this district in the manufacture of malleable iron, and it was puddled under my own supervision, and in the type of furnace and in the mode I have described. The puddled balls after being hammered, were rolled into 3 in. puddled bars, and I have here a common break test, and I have also a test made by reducing a sample to ¾ in. diameter, and testing it in an ordinary testing machine, which anyone interested can see. The breaking strain at the moment of fracture was 27.7 tons. I am not quite prepared to say how this result was obtained, but I leave the hint with works managers. So far, this is the best result that I have got from malleable iron, but it has not yet been fairly tried to ascertain what prospect it has of commercial success. I have great hopes of it.

*A paper read before the West of Scotland Iron and Steel Institute.

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CHICAGO, SATURDAY, SEPT. 26, 1896.

ABNORMAL conditions continue in most industrial lines, but there are several favorable indications of better times. Foreign requirements for farm products: it seems to be agreed among experts in such matters, will be large. Gold receipts now reaching nearly $40,000,000 promise to continue, and the flow of currency inland has already done good work. Its October return eastward will probably mark another step forward in the more liberal treatment by the banks of their customers when they will then have their fingers on a large portion of this increased volume of money. Several trade conditions are not worse but rather some better. Manufactures are purchasing raw material. There is an intimation of firmer prices should it continue. The iron trade is not quotably stronger although everything is working around right and there will soon be better reports. Bessemer is stronger. Billets are steady. Structural material is being asked about. Steel rails are flat and dull. Crude iron production is declining and consumers look for lower prices in expectation of stock being pushed into or possibly thrown on the market, but this hope is hardly a reasonable one.

A TRADE union paper recently made use of the following sentence than which nothing could be more true: "We pity the man who has a collar around his neck, a chain fastened to that, and some boss to lead him wherever he goes." In the journal in question the sentence was employed for the purpose of persuading men to break away from their allegiance to their employers and unite with a particular union for which the paper in question stood. If any one can point out a slavery more servile or an influence more autocratic than attaches to the ordinary labor organization, it would be interesting to know what it is. As too often conducted, these two organizations assume to control the action of their members despite their will, and to a degree that is unheard of in any line of employment; with the very material difference that in the one case the men are forced to contribute to the maintenance of their rulers, while in the other they receive compensation for their service. In the article referred to, an appeal is made to "be a man; exercise the rights of a man, and stand by your convictions." The same journal not a great while ago, was denouncing men in the severest terms because they chose to do this very thing. The convictions of these men led them away from the labor organizations, and no epithets were too vile for the use of the journal in question in referring to them.

THE advantages to be derived by the additional investment required for installing permanent structures of steel or stone instead of wooden ones in the form of railway bridges, have frequently been urged, and where the necessary money is available for putting in permanent work there is no question of the proper policy in this connection. Mr. W. F. Goltra, who has compiled a great deal of information in connection with the Lake Erie & Western Railroad argues that viewing the question of cost from a financial standpoint only, and figuring interest on investments for permanent work at five per cent it will pay to spend money for permanent work rather than for renewals of wooden structures in the proportion of three dollars to one. The cost of renewals of wooden structures is high and is constant as long as the structures are used and the expense of maintenance of permanent work is so much less, that the saving in the employment of the latter form is apparent. The life of wood in bridge structures and culverts varies with the climate and other conditions so that definite figures for their terms of service cannot be given, but the usefulness of timber structures cannot as a rule be taken at over nine years. Howe truss spans cannot be relied upon for more than about ten years, and piling gives out after a service of, say, eight years, if of Norway pine. If the cost of wooden structures, which can be used nine years is ten dollars per lineal foot and the cost of permanent steel bridges and stone arches to replace trestles of what may be termed ordinary hight, is fifteen dollars per lineal foot the difference in favor of the additional cost of renewing with steel and stone for any road may be found by a process of arithmetic. These figures can be applied only in a very general way but they indicate the advisability of spending the extra amount when it is available.

THE practice of using dummy couplings for hanging up air brake hose when not in use has been abandoned by several important roads. The Chicago, Burlington & Quincy was the first to lay this attachment aside which was done during the summer of 1894, when the question was decided by vote of the mechanical men of the entire system. The reason for this change was that the position of the dummy couplings caused a kinking of the hose, and fastening it up gave it an unnatural position which caused rapid deterioration. The object of hanging it upwas prevent the accumulation of dirt. This is very imperfectly accomplished however by the usual form of dummy hook and those who have given up its use believe that less dirt gets into the train pipe when the hose is allowed to hang down. Mr. J. F. Deems stated before the Western Railway Club some time ago, that he had found as much as a half pint of dust collected in the hose which was hung up at the rear of a fast train after a run of four hundred miles. If dummy couplings were tight the trouble with dirt would disappear entirely, and if they are properly located with reference to the hose there would be no trouble from kinking. A better method of closing the end of the hose when hanging down would offer a satisfactory disposition of the matter without the necessity of hanging the hose up after uncoupling. The practice of leaving off the dummies is extending. The example of the Chicago, Burlington & Quincy was soon followed by the Chicago, Milwaukee & St. Paul, and the Big Four, the Pennsylvania Lines west of Pittsburgh being the latest converts, both having come to this conclusion within the past few days. The Big Four will accept cars in interchange if they are without the dummy, which will not be renewed on old cars or fitted to new ones, neither will bills be accepted for their replacement by other roads. The Pennsylvania Company will not renew these parts or use them on new work. It is open to question whether this is a satisfactory disposition of the matter, but there is no doubt of the bad results from using the present prevailing form of dummy.

WHILE there is every reason to put forth the strongest possible efforts during the present campaign in the interests of sound money, there is some danger, because of some of the means employed, that class prejudices may be sufficiently aroused to operate unfavorably. Particularly is this true in connection with the efforts of class journals. Men are apt to regard with suspicion any sudden change of front, and in cases where journals, which for years have been indifferent, if not opposed, to what men consider their best interests, abruptly change their course and assume the role of an adviser and counselor, harm rather than benefit is likely to result. No where is this more apparent than in the railroad service. Although wholly unjustifiable, it is nevertheless a fact that the rank and file of railway employes are suspicious of the disinterestedness of railroad officials whenever they attempt to influence their actions, feeling that, in some way, an acquiescence therein will be harmful to them. If during the past years, railroad officials in their intercourse with their men, had demonstrated their interest in their welfare, the case would be different, but as a rule, and except in times of emergency, these officials are, apparently indifferent in such matters. We say apparently indifferent, for with scarcely an exception, railroad officials are anxious to improve the condition of those under them; a desire which circumstances often renders impossible of realization. The men, however, do not or will not appreciate this fact, and believing that the only desire of the officials is to get the most possible out of them for the least possible pay, they naturally antagonize the wishes of their employers. It is at least doubtful if it would not be better from this time forth, if railroad officials would abandon all efforts to personally advise their men in connection with the coming election. Enough has been said to supply all needed information to a class of men so intelligent as are the railway employes of the United States, and they may be safely left to work out the problem without any extraneous influences, particularly when it is of a character that is likely to awaken the spirit of resentment.

ANOTHER illustration of the futility of endeavoring to regulate rates by means of voluntary association where such association is dependent only upon the pleasure of its members, is afforded by the withdrawal during the current week, of two members of the Western Freight Association from that organization. The causes leading up to this action will be discussed hereafter, but mention is now made simply to emphasize the oft repeated assertion that if rates are to be maintained upon a paying basis, the pooling principle must be re-established. There is enough influence possessed by the railroads of the United States if only united in such purpose, to effect a revision of the interstate commerce law in this respect in the near future. It is true that the coming session of congress is a short one, but it is probable that upon the advent of a new president it will be succeeded by a called session, and opportunities will thus be given for this much needed legislation. The policy heretofore pursued by the railroads in connection with this matter should be immediately abandoned, and they should unite with the Interstate Commerce Commission and the various commercial bodies throughout the country, in securing a passage of what is known as the amended Patterson bill. It is conceded that from the standpoint of either of the three parties mentioned, the bill could be improved in some particulars, but as a compromise, and particularly as securing two or three of the most necessary reforms, it is doubtful if any better bill could be prepared. So far as the railroads themselves are concerned they need to understand that whatever may be the facts in the case, the maintenance for long continued periods of abnormally low rates, furnishes to the minds of those who hereafter are to prescribe their rates, abundant evidence of their reasonableness, and all the facts, figures and arguments that may be presented to overthrow such a conviction, will be altogether futile. No time should be wasted in further discussion of this question, but all parties should at once unite and use their combined influence towards the early introduction of the bill and its rapid progress through congress.

"GOVERNMENT by injunction" has been a very favorite term with those who have sought to decry the application of this method of restraint, and it is possible that because of a new direction given to this method, objections will be still more loudly voiced. The action of Judge Speer of the United States district court of Georgia, in issuing a mandatory order compelling the roads in that territory, which had for some time been engaged in a ruinous rate war, to restore rates to their normal basis, will doubtless be made the occasion of severe criticism

by those who believe themselves free to do what they please with what they consider their own property, regardless of the effect which such action may have upon the property of others. As to the advisability of the means employed to accomplish the desired result, this journal does not profess to be competent to speak, but as to the necessity for some means whereby the owners of railroads may be protected in the legitimate operation of their properties, there can be no manner of doubt. If the government assumes the right to in any degree, control the action of a railway in respect of revenue, it would seem to be obligatory that such protection as is necessary to secure such revenue should be afforded. And if also it is within the province of government to forbid discrimination by a single railroad, and to require that under similar conditions it shall render equal and exact service to all, then it would seem only proper that it require or at least permit such an adjustment of rates and charges between several roads serving the same individuals as would accomplish a similar result. Of the merits of the particular controversy in question between the Seaboard Air Line and the Southern Railway, it is not now proposed to speak, but it is, desired to say that the power should not be possessed by any one to so completely destroy the revenues of a railroad on the one hand, and to affect such glaring discriminations in respect to charges to the patrons of the various railways on the other hand, as has been the case in the rate war between the lines in question just terminated by the order of Judge Speer above referred to. It might be well if a similar proceeding could be had in connection with the rates now in effect in the territory of the Western Traffic association, and thus put an end to a condition which now promises to effectually bankrupt all of the roads in the territory in question.

THE STEAM TURBINE.

The desirability of a steam engine to operate in such a way as to avoid the reciprocating motion of ordinary patterns has occasioned an immense number of attempts to construct a rotary engine. The so-called rotary engine has not been commercially successful for reasons which are too well known to require enumeration, but the progress which has been made in the direction of steam turbines has brought this form of prime mover into a position which entitles it to most respectful attention from steam users. Until quite recently steam turbines have been built in small sizes only, and while they have been successful, the question of applying the principle in large power units has been problematical. Some interesting tests were described by Prof. Goss, of Purdue University upon a 10 h. p. De Laval steam turbine in a paper before the American Society of Mechanical Engineers, and which was published in the RAILWAY REVIEW of December 7, 1895. The steam consumption was 47.8 pounds per horse power per hour, which, considering the small power of the engine, is a remarkably good figure. Mr. M. L. Fayot made some tests in July of last year on a 50 h. p. steam turbine of the same type which gave a consumption of steam of 19.58 pounds per brake horse power at the turbine shaft. The results of his experiments were recorded before the Societe Internationale des Electricians. It is interesting to know that just previous to this trial the turbine had run continuously for 3,300 hours. In another series of tests, three turbines at an electric supply station in Paris, which were each rated at 75 h. p., worked on a consumption of 20.3 pounds of steam per brake horse power at the turbine shaft. In these cases the friction of the machine itself is eliminated and the figures therefore stand better than those usually expressed for ordinary engines in terms of indicated horse power. Again a 100 h. p. turbine at the Bordeaux exhibition in 1894, when working with a condenser, gave a horse power on the consumption of 20.15 pounds of steam and at half load it consumed 23.8 pounds per brake horse power, the vacuum being 21.6 inches.

The results already quoted have been surpassed by a turbine of 300 horse power at the Twelfth Street station of the Edison Illuminating Company of New York. There are two turbines of this size at this station which are coupled direct to Desroziers dynamos. The tests were made April 2, 1896, and consisted of a run of six hours, during which the readings of the electrical measuring apparatus were taken at five minute intervals independently, by two observers. The result was a steam consumption of 17.348 pounds per brake horse power per hour, or 19.275 pounds per electrical horse power per hour. These turbines, operating under a steam pressure of 145 pounds per square inch and a vacuum of 26 inches, were guaranteed to work on a steam consumption of 18.7 pounds per brake horse power per hour. During the test the steam pressure averaged 150 pounds and the vacuum averaged 25.74 inches. If anything more than the previously recorded tests were required to establish the steam turbine among economical engines these records will serve the purpose, and its application to practical work seems promising. Not the least favorable feature of this form of engine is the compactness of its design, and it is stated that the weight of one whole unit consisting of a 300 h. p. turbine and two 100 k. w. Desroziers dynamos, is less than 70 pounds per horse power of output when running at the ordinary speeds. The space occupied by this apparatus at New York, including the dynamos, is 13 feet 3 inches in length, 6 feet 6 inches in width and 4 feet 3 inches in hight.

These machines are run at a very high speed, that of the test just referred to being 9,000 revolutions per minute, and it is stated on good authority that a speed of 25,000 revolutions per minute has been attained by another form, the Dow turbine. A comparatively high speed is rendered necessary by the principle employed by this use of steam, the reason for the high speed being that the contact between the steam and blades of the turbine should be free from blows and that the velocity of the discharge should be as low as possible. A difficulty introduced by the high speeds, on account of the impossibility of accurately balancing the revolving parts, has been solved in the DeLeval type by making the shaft flexible, and while this practice has been severely criticised, no difficulty seems to have developed in service in connection with it. There also seems to be no difficulty in securing satisfactory speed regulation, which renders the turbine especially applicable to electric generation for light and power. The results of the trials in New York are surprising, and they are to be accounted for chiefly by the absence of the waste entailed by contact of the steam with cooling surfaces. The steam turbine is entirely free from the serious losses which exist in reciprocating piston types of engines through cylinder condensation and re-evaporation.

Association of Railway Superintendents of Bridges and Buildings.

The following circular has been received from the secretary of the Association of Railway Superintendents of Bridges and Buildings announcing that the sixth annual convention of the association will be held at the Leland hotel, corner of Michigan avenue and Jackson street, Chicago, on Tuesday, October 20, 1896. The following program has been arranged:

Tuesday, October 20, 1896, Morning Session—The convention will be called to order by the president at 10 o'clock. Prayer by J. H. Cummin. Address of welcome by the mayor. Reply by the president. Calling the roll. Reading of minutes of last meeting. Report of committee on applications for membership. Admission of new members. President's address. Reports of secretary and treasurer. Payment of annual dues. The afternoon session will be called to order at 2 p. m. Appointments of committees on auditing, nominations, subjects for discussion and resolutions. Reports of committees. Unfinished business, including discussion of reports of last meeting. New business.

Wednesday, October 21. Morning Session—Called to order at 10 a. m. Discussion of reports of committees. Investigation, reading and discussion of questions propounded by members. The afternoon session will be called to order at 2 p. m. Continuation of discussion of reports.

Thursday, October 22, Morning Session.—Called to order at 10 a. m. Miscellaneous business. Election of officers. Adjournment. The afternoon will be devoted to excursions, which the committee on arrangements, Messrs. J. H Travis, Aaron S. Markley, G. J. Bishop, and O. J. Travis have planned.

Friday, October 23—Will be spent in an excursion to the drainage canal, returning in time for members to take night trains out of Chicago.

Members should apply for transportation for themselves and ladies, through their general management in advance. Pay for Pullman or Wagner accommodations, going, taking a receipt for same, and a free pass will be given returning by presenting same with credentials to Mr. W. H. Reed of the Pullman Company, or Mr. J. A. Spoor of the Wagner Company. Accommodations for members and ladies will be furnished at the Leland at the rate of $2.50 per day for rooms without bath. Hotel to furnish club room for use of convention free of charge. All members of the association are urged to attend this meeting, which will prove to be a pleasant and very profitable trip for all. Members are requested to state on the enclosed postal card if they do or do not expect to attend the convention, and mail the same promptly to the secretary. A cordial invitation is extended to all railroad officials interested in the aims and purposes of this association to attend the sessions of the convention.

The following is the list of subjects and names of committees assigned to each:

1. How to determine the size and capacity of openings for waterways—Aaron S. Markley, J. S. Berry, C. C. Mallard, J. L. White.
2. Different methods of numbering bridges—A. Shane, W. O. Eggleston, J. L. Soisson, O. J. Travis.
3. Drawbridge ends, methods of locking, and under this head including locking of turn tables—H. M. Hall, James Stannard, H. Middaugh, C. C. Mallard.
4. Protection of trestles from fire, including methods of construction—R. M. Peck, T. H. Kelleher, A. McNab, W. M. Noon, G. W. Hinman, Wm. Berry.
5. Local stations at small towns and villages, giving plans of buildings and platforms—J. H. Cummin, N. M. Markley, J. H. Markley, C. G. Worden.
6. Tanks, including frost-proofing, size, style and details of construction—W. O. Eggleston, W. M. Noon, A. McNab, N. W. Thompson.
7. Shearing of rivets on plate girders and cause thereof—J. M. Staten, R. L. Heflin, J. H. Travis, G. M. Reid.
8. Best and uniform system of report blanks for bridge and building department—G. J. Bishop, W. O. Eggleston, Onward Bates, M. Riney.
9. Protection of railroad structures and buildings from fire—Charles Parsons, R. M. Peck, L. K. Spafford, B. T. McIver.
10. Brought forward from 1894. Mechanical action and resultant effects of motive power at high speed on bridges—G. W. Andrews, W. G. Berg, J. E. Greiner, E. H. R. Green.
11. Brought forward from 1894. Best and most economical railway track pile driver—J. L. White, A.C. Davis, J. F. Mock, J. T. Carpenter, G. W. Hinman.
12. Brought forward from 1894. Span limits for different classes of iron bridges, and comparative merits of plate girders and lattice bridges for spans from 50 to 110 feet—W. A. McGonagle, R. M. Peck, W. M. Noon, H. E. Gettys, G. J. Bishop, Onward Bates.
13. Brought forward from 1894. Interlocking signals—J. H. Travis, W. S. Danes, R. L. Heflin, J. A. Spangler.

REPLACEMENT OF WOODEN BRIDGES WITH PERMANENT STRUCTURES.

The second report of the characteristics of the Lake Erie & Western Railroad prepared by Mr. W. F. Goltra, C. E. contains the following paragraphs with regard to the reconstruction of wooden structures with permanent ones built of stone and iron and the filling of trestles with earth:

On Jan. 1, 1887, there were 66,243 lin. ft. of bridges, all of which except 523 lin. ft. were wooden structures. The permanent work then consisted of two iron girders, a few stone arches and stone boxes, 34 cast iron pipes and 146 terra cotta pipes. Since the present management took charge, on February 1, 1887, permanent improvements have been made, gradually reducing the length of wooden structures from 65,720 to 31,037 lin. ft. and permanent work has been substituted to the extent of 34,683.7 lin. ft. being composed of 9,510.3 lin. ft of iron, steel or stone structures, and 25,173.4 ft. of solid earth embankment, shortening the aggregate length of bridges to that extent. Most of the costly structures have been built, and the average rate of $18.96 per foot is higher than it will be for future permanent work, the cost of which is approximated at $15 per foot of permanent work.

A few of the wooden structures were built in recent years and will not need renewal before six or seven years. It is estimated that the work of completing the permanent improvements will be done by January, 1903. As the annual appropriation for this work is dependent on the financial condition tion of the company, and also on the number of structures that require renewal, the estimated progress may vary but it is probably not far out of the way. The estimated cost of completing the permanent structures is $420,000. Some wooden structures to the extent of about 3,000 lin. ft., may be renewed with wood owing to certain conditions that will not admit the substitution of economical permanent improvements and the renewals of these is not included in the estimate. The length of bridging is being rapidly shortened by filling with earth, making solid embankments, and it is estimated that of the original 66,243 lin. ft of bridging on Jan. 1, 1887, about 45,000 ft. will be replaced with solid embankment, reducing the total length of bridging to 21,243 ft. on January 1, 1903.

Returning to cost per foot of permanent work, where iron pipe culverts, stone arches and boxes can be used, and the depth does not exceed 15 ft., the cost of permanent work is but little more than that of renewing wooden trestles, and seldom exceeds twice the cost, including the cost of filling openings with earth.

For larger openings, where plate girders and masonary are necessary, the cost is little more than twice and seldom exceeds three times the cost of renewing wooden structures. The average life of wooden structures on this road is nine years and the cost of wooden trestles, not exceeding 15 ft. in hight is $7 and wooden truss bridges $28 per lineal ft.. Taking all the wooden structures into consideration, the average cost to renew them would have been an average of about $9.90 per ft., while the permanent improvements will cost, when completed, an average of about $17.20 per ft.

If we view the question of cost from a financial standpoint only and assume the interest at 5 per cent on the investment for permanent improvement, the life of wooden structures at nine years, and average cost of same at $9.90 per ft. it is easy to calculate that it would be profitable to spend $3 for permanent work rather than to spend $1 for renewal of wooden structures, and as the ratio of cost for renewal of wooden structures and permanent work will only be about as one to two, the saving by making permanent work is apparent. But aside from this, what is saved by the reduction of openings in the track, thereby eliminating danger of fires, wrecks and accidents, is incalculable. The conclusion is, that if there is money available to make a roadway of permanent character at the earliest possible moment, it is certainly an element of economy in the operation of a railroad.

COMPRESSED AIR IN FOUNDRY PRACTICE.

At the September meeting of the Western Foundrymens' Association, held in Chicago, papers were presented by Mr. George A. True, entitled, "Compressed Air as a Hoisting Power in the Foundry" and by Mr. Curtis W. Shields, entitled, "Compressed Air and its Economies in the Foundry" Abstracts of these papers are given below, the first being by Mr. True.

If the writer were to-day installing a foundry of, say, 20 to 50 tons daily capacity, the temptation would be very strong to adopt compressed air as the only transmission power. We are not aware that such an example exists in foundry practice, and can recall but one instance where this system has been adopted as the prime distributing power by a manufacturer in any line, and that one, the Weurpel Co., of St. Louis, was unfortunately short lived and afforded but little opportunity to show what could really be done.

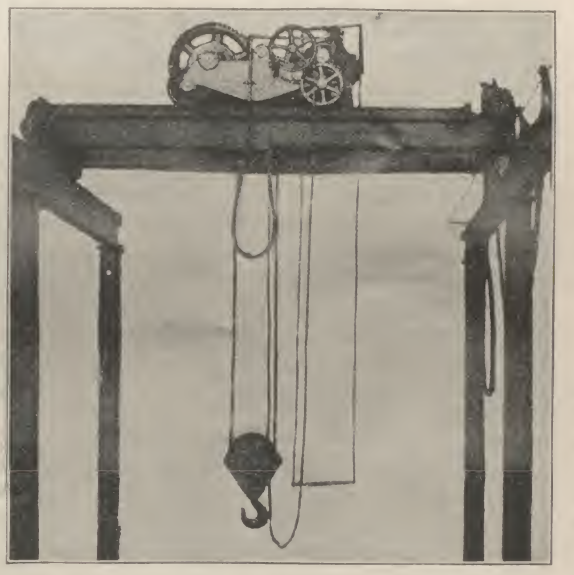
Mr. Richards asserts that compressed air costs about five cents per 1,000 cubic feet of free air. This is the basis usually taken in making estimates, and at first thought it seems to be very cheap, but with a modern four-stage compressor the cost will be much less; in fact, in some cases it is difficult to see how the cost per 1,000 cubic feet of free air can reach four cents, including depreciation, repairs, oil, fuel, interest and miscellaneous items. Assuming five cents, however, as a basis, the power cost of lifting one ton one foot, in a direct acting air hoist is about 7-1000 of one cent, or to put it on a more comprehensive basis, seven cents per 1,000 ton-feet. We have already seen that the average amount of hoisting in a foundry of 30 tons daily output was 2,000 ton-feet, so the power cost of doing this work, including power repairs, power labor, fuel, oil, interest, etc., is not over 14 cents per day. The operating labor is to be added to this to estimate the total cost of hoisting. (In these calculations the hoisting is alone considered, and we may assume that lowering is done as cheaply by one power as another). In order to obtain the operating labor cost we must first obtain the speed of hoisting. We have made a series of tests with hoists ranging in diameter from 4 in. to 16 in., and in capacity 600 pounds to 6 tons. On small hoists the valve ports were approximately of 1-10 in. area, on larger hoists some were of this area, others of 1-5 in. area. The speed of hoisting varied from 25 ft. per minute in 6-in. hoists, fully loaded, to 6 ft. per minute for 6-ton hoists. The average speed was found to be not far from 20 ton-feet per minute. Of course under high pressures this would be increased, but the object was to find a safe average speed for normal service.

Taking this on a basis of 2,000 ton-feet per day, assuming the operator's labor at $2 per day, we have an operating or attending labor of about 25 cents per 1,000 ton-feet. The total cost, therefore, of hoisting one ton 1,000 ft. will be about 32 cents, or in a foundry of 30 tons daily capacity about 65 cents per day, using direct-acting vertical air hoists. If geared hoists are used, the amount of air necessary to lift a ton-foot will be increased and the power and operating cost will be more nearly represented by 90 cents per day.

Here we may call attention to the fact that the ordinary vertical direct acting air hoist is one of the most efficient hoisting machines in use. It utilizes in useful work fully 85 per cent of the power delivered to it. Few geared hoists, electric, hand, air motor or steam, have a higher efficiency than 60 per cent. Some electric cranes show a loss of 65 per cent in friction, or 35 per cent efficiency, although the average efficiency of the electric crane gearing is perhaps nearer 50 per cent. The average hand power crane with a drum winch shows only about 45 per cent efficiency, based on the power delivered to the machine. The average differential or worm-geared chain-hoist has 30 to 40 per cent efficiency, and the cost of operating, measured in time and wages, is immense.

For the purpose of comparison, assume the foundry mentioned above to be equipped with hand power cranes. The average speed of hoisting by hand power, using one man, is about one ton hoisted two feet per minute. For short time work it is a little greater but for steady work it is less and on chain blocks or worm gearing it is not much more than one ton one foot per minute. At a "two ton foot rate" it would cost by hand power $2.50 per 1000 ton feet, against 45 cents per 1,000 ton feet for air hoist doing the same work. Or, roughly, in a 30 ton per day foundry, $5 per day represents the labor of hoisting by hand power against 65 cents to 90 cents per day by air hoists—a saving well worth considering. It may be pointed out that this saving would be equally great when using other mechanical power than air, but this would be true only when applied under certain conditions, as for instance, handling uniformly heavy loads, and even then, as indicated, the power item would be 40 to 50 per cent greater, owing to the low efficiency of the geared machine as compared with a direct acting vertical hoist.

Thus far comparisons have been made with the direct acting or "cylinder" hoist, which is essentially a cylinder of cast iron, or steel, or brass, accurately bored and polished inside, and fitted with a piston and piston rod, and to the latter is attached a hook, and on the cylinder a hook or ring is provided for attachment to the trolley or beam overhead; the cylinder thus hangs vertically and the load is lifted by the admission of compressed air on the under or "piston rod end" of the cylinder. This is apparently a simple machine, but if accurate or efficient work is desired great care and experience is necessary to



A PNEUMATIC TRAVELING CRANE.

properly construct it. Once properly made it is easy to take care of, its parts are few and not subjected to much wear, and are cheaply and easily replaced when worn. A poorly designed hoist or one cheaply constructed is not a good investment.

When applied to cranes, positive action of the load may be obtained by the use of a water reservoir between the air pipe and the hoisting cylinder, with a regulating valve between reservoir and hoist. The hoisting cylinder then becomes practically a hydraulic hoist and should be constructed as such. The whole appliance is essentially a hydro-pneumatic hoist. The speed may be perfectly controlled by the regulating valve, or the load may be held indefinitely by closing this valve. An appliance of this kind is of course open to the same objections that are advanced against a hydraulic hoist, especially in an exposed location subject to a freezing temperature. This may be overcome, in a measure, by the use of oil or an anti-freezing mixture in the reservoir. The hoisting cylinder may be placed horizontally with the reservoir below it, but there is less friction and better results generally obtained from a vertical cylinder.

Undoubtedly the electric crane owes its popularity largely to the ease of transmitting the power from a fixed point to a moving machine. Until its appearance, the power traveling crane in general use was either belt or rope driven or operated by a square shaft. The power was subdivided and reversed by an intricate system of clutches, bevel gears and frictions. No one would now think of returning to that "all day" fuel consuming method unless the crane travel was exceedingly short, or the conditions much more favorable than usual. The electric crane offered emancipation from such systems, in the form of independent motors for each function, an easy method of reversing, and a consequent minimum of mechanism outside of the motor, a variety of speeds and a simple and highly efficient method of transmission.

The three-motor compressed air traveler possesses all these good points, with the addition of lower first cost and greater simplicity. With a proper pipe line the transmission loss is less than in electricity. The engines are as simple as those used for steam, and may be easily reversed and controlled. Rheostats and expensive controllers are not needed; and the speed is reduced by throttling and saving the power rather than by consuming it. The valves may be controlled as easily from the floor of the shop as from a cab—a feature well worth consideration in a shop of limited output where a crane man's time in a cab is a serious item of expense.

The air is usually carried in a rubber hose. The slack of the rope is supported by a number of small trolleys riding a taut horizontal wire along the crane runway. The hose connection is made at one end of the runway and as the crane travels out it simply pulls the hose after it, and when it returns the hose is pushed before it, folding back against itself as the trolleys are pushed together. We have carried air in this manner a distance of 250 ft. without the slightest trouble. The beauty of this system compared with other hose systems is the absence of couplings and connections and the consequent small opportunity for leakage. Sometimes when the travel is long, several wires are used, each supporting a separate trolley. The connection between the main supply pipe and the hose may then be made at any point along the track, for the trolleys can pass each other. The hose in all cases should be amply large, ¾ to 1½ in., depending upon distance, and three to four-ply of good quality.

Air engines may be applied to jib cranes, elevators and other hoisting machinery with equal ease. They may be applied to the travel gearing of a crane with relatively equal saving as when applied to the hoist. Compact reversible engines may be readily and cheaply applied to present hand power cranes without materially changing the design, and the crane may still be operated by hand power at times when the power plant is not in operation. Air may replace steam in engines now is use on steam cranes. It is somewhat remarkable that founders making cast iron water pipe have not long ago adopted compressed air as a crane power. The conditions are peculiarly well suited for air; excessive heat, dust, smoke, intermittent work, and widely scattered machines in foundries of this class all offer it an inviting field. At present many of these foundries are operated by steam jib cranes, which could easily be converted into air driven machines. Some of the more recently built pipe foundry plants have installed electricity on traveling cranes, but if there is any place where air would be emphatically advantageous it is in these shops. With steam there is a great loss through pipe condensation, and the already heated air is rendered further uncomfortable for escaping steam and heated engines. Compressed air could be exhausted directly into the atmosphere of the shop and would assist in some degree in cooling and ventilating. There would be practically no loss in the pipes, as compared with steam. Air is a humane power. It does not hurt a man if he is struck by a jet. It dosen't make him uncomfortable. It is the most pleasant of all transmission powers to handle and the most convenient to subdivide.

The application of air motors also, to the gearing of existing hand power cranes, would result in a large annual saving; it would in many cases pay for the investment in less than one year after installation.

Making a comparison with hand power, as already stated, the cost of hoisting by manual labor in the foundry under consideration would be not far from $5 per day, equivalent in good times to $1,500 per year. By air, it would cost $200 to $250 per year, or, if we include interest on the investment, which is only fair, we will have a hoisting cost, when operated by hand power, of about $1,600, against $380 to $480 using air. The saving would go far toward purchasing a first-class air plant.

ECONOMIES OF COMPRESSED AIR IN THE FOUNDRY.

The great economy of an air hoist is well illustrated in the following record of actual work performed in the foundry of Messrs. Russell & Co., of Massillon, O. In making wheels for their traction engines, a molder and helper formerly made one mold per day of a wheel 16 in. face by 66 in. diameter. During the entire operation of molding and pouring, 104 hoists and lowers were necessary. With the old crane, it took these two men from five to six minutes to turn a flask, when assisted by a laborer on the windlass. Now, with the air hoist, the laborer is done away with, and they turn a flask in two minutes. This saves in time alone 52 times 3½ minutes, or three hours per day, and the molder and helper make in the time saved by the air hoist two 58x12 in. wheels in addition to the large wheel, which formerly constituted a day's work. In this same foundry a test of one of their jib cranes gave the following:

Area of piston, 452.39 sq. in. (24 in. diameter.)
Hight of lift, six feet.
Hoist, two feet to one foot of piston travel.
Weights lifted, 2,000, 4,000 and 5,000 lbs.
Main air receiver gage, 100 ft. from crane, registered 63 lbs. pressure.
Gage on hoisting cylinder, 30, 40 and 45 lbs. for the respective hoists.

It was found that it took 10 lbs. pressure on hoisting cylinder gage to overcome the friction of the chains wrapping around the sheaves, as well as of the packing in the stuffing box of the piston rod and the frictional resistance of the piston against the cylinder walls.

Wgt. lifted 6 ft.	Press. on piston.	Deducting 4523.9 lbs. as being the amount required to overcome all resistance except load we get.
2,000 lbs.	6785.85 lbs.	2261.55 lbs.
4,000 lbs.	9047.80 lbs.	4523.9 lbs.
5,000 lbs.	10178.77 lbs.	5654.87 lbs.

The excess of 261.55, 523.9 and 654.87 lbs. in the respective cases is, no doubt, due to the fact that the chains are hugging the sheaves tighter under the loads than when empty, and this increased friction must be overcome at the expense of pressure. The 10 lbs. required to overcome the load and frictional resistance of the chain, chain block, etc., in the crane itself is not altogether wasted for the space in the cylinder between the piston and the head on lifting side being once supplied with this amount is then ready to do useful work. A 24 in. cylinder with piston moved three feet would contain 28.275 cu. ft. of free air if

the gage on the cylinder showed 30 lbs., or two atmospheres pressure, and 10 such hoists would use 282¾ cu. ft. of free air. This amount of air would not cost over one and one-half cents. With compressed air at five cents or less per 1,000 cu. ft. of free air delivered at 100 lbs. pressure, this is vastly cheaper than a gang of men on a windlass with the molders standing idle an indefinite time. The frictional loss in direct air hoists has been shown by tests made by the Whiting Foundry Equipment Co., not to exceed 15 per cent. A lot of 12 hoists taken at random showed a varying loss of from 9.2 to 23 per cent average 12.9 per cent loss. Another lot of 10 averaged 14.65 per cent loss.

Large compressed air traveling cranes are coming into use in foundries, and a short discription of one at the works of the Ingersoll-Sergeant Drill Company, at Easton, Pa., which has a novel single eccentric reversing gear, may not be uninteresting.

This is a 20 ton traveling crane with a 40 ft. span. (Shown in the accompanying illustration.) It has three duplex air engines, one for each motion of the crane. The engines are reversible and very simple in construction, each cylinder having a valve which has both a rocking and a shifting motion, the cylinders having two sets of ports, one set direct and the other crossed or leading to opposite ends of the cylinder. With this arrangement, only one eccentric is required for a cylinder, and the engine is reversed by shifting the valve by air. There are two air pipes leading to the valve chest of each engine, the other end of pipes leading to a valve box on the cage of the crane. In this valve box are three slide valves operated by levers which control the speed and direction of the three movements of the crane. When the levers of the valve box are in a central position, the ports in the valve box are covered and the crane is stationary; but when moved in either direction, air is passed through one of the two pipes leading to an engine which shifts the valve and brings one set of ports into play, making the engine run one way. When shifting the lever in the opposite direction, air is passed through the other pipe leading to the engine, the valve is shifted in the opposite direction and the engine is reversed in its movement.

The travel of the crane is 460 ft., and air is applied to same through a continuous hose of about 480 ft. in length, fastened to the building at one end and to the crane at the other, and it is held up at intervals of 25 ft. with cast iron swivel sliders which move on channel beams bolted to the roof of the building. On the forward movement of crane, the hose is drawn out very nearly straight, and on the return movement it falls in loops, the hose turning on the swivel joint as the two slides come together, making it set at right angles to the slides. In this position the hose occupies very little room, the 480 ft. when looped up, using only about 10 ft. of track.

Compressed air cranes have many advantages over those electrically driven for foundry work, as the dust and heat which materially effect the efficiency of electric motors have no appreciable effect on the air motors.

NOTES ON THE INTRODUCTION AND DEVELOPMENT OF ROPE DRIVING.*

BY ABRAM COMBE.

Introduction of Rope Driving.—So much has been said and written on the advantages and application of rope driving, and so many data and formulæ have been published from time to time, that it is hardly necessary to add to the information already available in these respects; but as rope driving emanated from Belfast, and has now grown to such large proportions in the industrial transmission of machanical power, a short history of its origin, introduction, and development, may prove of interest on the present occasion. Its introduction is due to the late Mr. James Combe, who in 1856 applied an expanding pulley with V-shaped sides to the differential motion of flax and tow-roving frames. The expanding pulley was driven by a round leather rope from a driving pulley grooved with a V-shaped groove. In the course of his experiments in perfecting this motion, he was struck by the large amount of power obtained from round ropes working in V shaped grooves; and this led him to try their application to the transmission of larger powers. With a view of arriving at the most effective angle for the grooves, a series of experiments were made in the Falls Foundry works in the following manner. A pulley, fixed for revolving was made with a number of grooves, each having its sides sloping at a slightly different angle from the others; ropes were then laid over these grooves with weights hanging from one end and counterbalance weights at the other; and the effect produced on the biting power of the rope in the groove by increasing and diminishing the weights and the counterbalance weights was carefully noted. The object was to determine in a practical manner the most suitable angle of groove for a driving rope, so that the rope should neither slip nor yet bite to much into the groove; and the angle chosen after the above simple experiments, namely 45 deg., was adopted in the first pulleys set to work, and is at present generally used for rope driving under ordinary conditions.

After several years' use of grooved pulleys and ropes for driving from the main shaft of one on the workshops at the Falls foundry to that of another, the advantages of rope driving under certain conditions were found to be so great that, on the occasion of replacing one of the main engines in the beginning of 1863, rope driving was adopted for transmitting the entire power of the engine, amounting to over 200 h. p., from the second motion shaft to the principal shaft. This is the first instance of rope driving being used for a main drive of such importance, and the original pulleys are still in existence and working daily.

Material of Ropes.—About that date round ropes made of leather strips were generally used. These, however, were found to have the objection that they were liable to untwist, and the ends of the leather strips were apt to fly out during the working and cause trouble. Moreover, the strips of leather being cut out of the hide in a spiral were less strong where cut from the smaller diameters, and were liable to break at those parts. Manila ropes were then tried with good results, and leather ropes gradually gave place to ropes made from manila.

Relative Diameters of Ropes and Pulleys.—It was early recognized by the late Mr. James Combe that it is necessary to proportion properly the diameter of the ropes to the diameter of the pulleys on which they work; and he adopted the following minimum diameters of pulleys for the various sizes of ropes:—

1¼ in. diam. rope, 3 ft. diam. pulley: ratio 1 to 28.8.
1½ in. diam. rope, 4 ft. diam. pulley; ratio 1 to 32.0.
1¾ in. diam. rope, 5 ft. diam. pulley; ratio 1 to 34.3.
2 in. diam. rope, 6 ft. diam. pulley; ratio 1 to 36.0.

Experience has shown that the results have not been so satisfactory when ropes of above sizes have been used on pulleys smaller than the above minimum diameters.

Power Transmitted.—When working under ordinary conditions, the following simple bases were taken from which to calculate the power that each of the foregoing sizes of rope would transmit for each 100 revolutions per minute made by the pulley upon which it is working:—

Rope 1¼in. diameter on a 3ft. pulley, 5 I. H. P.;
Rope 1½in. diameter on a 4ft. pulley, 8 I. H. P.;
Rope 1¾in. diameter on a 5ft. pulley, 11 I. H. P.;
Rope 2 in. diameter on a 6ft. pulley, 15 I. H. P.;

and for other sizes of pulleys the power transmitted is calculated to be increased in direct proportion to the diameters of the pulleys. When working under the most advantageous conditions—for instance, where the ropes are running horizontally at good speeds, with the pulleys at a proper distance apart, and with the bottom rope acting as the driver—the above bases may be increased by 20 to 25 per cent. with safety. On the other hand, when the ropes are working under unfavorable conditions, with centers of pulleys too close together or ropes running vertically, these bases must be diminished by 20 to 25 per cent. The exact amount of increase or decrease on these standard bases has to be determined in each individual instance according to the circumstances under which the ropes are working.

Speed of Ropes.—The speed originally adopted as being the most advantageous was about 3,300 ft. per minute. This speed has since been far exceeded in many instances; but it is a question whether advantages have been reaped proportionate to the power gained by the increased speeds. On the contrary, the gain of power by increased speed is largely counteracted by loss of power from atmospheric friction and from centrifugal action; and when this loss is taken into account, along with the increased wear and tear on the ropes and bearings, the speed originally adopted, and speeds within certain limits of it, have been found to give the best results.

Cotton Ropes.—Later on in certain districts, especially those in which the cotton industry prevailed, cotton ropes began to be used. These have the advantage of being more pliable than manila ropes, especially when the latter are new. The relative merits of ropes made of manila and those made of cotton have frequently been discussed; but experience has shown that, if the pulleys are properly designed and applied, and if the ropes are the proper diameter, good results are obtained, whether the ropes are made of manila or of cotton.

Endless Rope for Close Shafts.—In 1878 grooved pulleys and rope driving were introduced to replace pairs of large geared wheels, which from one cause or another were giving trouble; for example, in places where they were used to combine the power from a steam engine with that from a water wheel, or to combine the power from two engines working under slightly different circumstances. Here the centers of the wheels were so close together that ropes if applied separately in the ordinary way, would have been too short for effective driving, and there would have been difficulty in putting equal tension upon each of the several ropes. Consequently, in order to secure a proper length of rope and equal tension, a single continuous rope was used which was laced round and round the pair of pulleys, passing from the first groove of the driving pulley to the first of the driven, thence back to the second groove of the driving pulley, and on again to the second of the driven, and so on; and a tension pulley was added for leading the rope back from the last groove into the first.

Rope Fly-Wheels.—The continued rapid extension of rope driving, and more especially of driving direct from the fly-wheel of the engine to the various shafts led to designing fly-wheels to suit the high speeds. A rope fly-wheel was designed by Mr. James Barbour in 1879 to meet the special requirements. The peculiar advantage of this method of constructing fly-wheels is that instead of depending solely on a cast-iron arm for connecting each segment to the nave, a strong wrought-iron bolt is used, which passes down through the middle of the tubular cast-iron arm, and connects each segment directly with the nave; consequently, this bolt not only receives the tensile strain caused by centrifugal force while the wheel is in motion; but it also withstands the driving home of the cotters when the wheel is being put together. When cast-iron alone is used for the arms, the driving home of cotters is a frequent source of breakage, which may not be detected until the fly wheel gives way; whereas by driving the cotters into a long malleable-iron bolt there is less danger of fracture. The starting worm or barring engine is made with three pawls for barring round in order that the motion may be continuous, instead of intermittent, as it is when only one or two pawls are used.

Substitution of Rope Driving for Geared Wheels, and Relative Amount of Power Absorbed.—In many instances existing gearing and upright shafts have been thrown out and replaced by rope driving; and where the rope driving has been properly designed and erected, the total power required for the rope driving has in none of the installations which have come under the writer's observations exceeded that which was required when driven by wheel gearing; and in many cases the power required to drive the same amount of work by ropes have been less than it was before the change in method of driving took place.

The above examples of the transmission of mechanical power by ropes serve to illustrate the development of this method of driving. Numerous variations have, of course, been made upon each of these plans, which have largely extended the field for the application of rope driving; so that this method of driving, which arose from such a small origin, is now widely adopted for industrial purposes. There is also no doubt that other developments will take place in the future, which will further extend its sphere of usefulness.

*Abstract of a paper read before the Institution of Mechanical Engineers of England.

NOTICES OF PUBLICATIONS.

Mr. Geo. H. Daniels, the able general passenger agent of the New York Central Railroad, has really outdone himself in his latest book. The title of the book is, "Two Days at Niagara Falls," and it is the latest issue of the Four-Track Series—one of its most attractive numbers. It is a narrow octavo volume of 64 pages, beautifully printed on heavy coated paper with illuminated cover. The book is full of reproductions of photographs of scenes about the Falls and that wonderful 38 miles of river, gorge and cataract, extending from Buffalo, on Lake Erie, to Youngstown, on Lake Ontario, through which rush the waters of the great lakes on their way to the ocean. As Edwin Arnold puts it: "Before me the great cataract of America is thundering, smoking, glittering with green and white rollers, hurling the waters of a whole continent in splendor and speed over the sharp ledges of the long brown rock by which Lake Erie, 'The Broad,' steps proudly down to Ontario, 'The Beautiful.'"

Most of the pictures are so remarkable that one can hardly believe that he is looking at an actual scene of nature, and becomes impressed with the idea that it is a fancy sketch before him; but all are reproductions of photographs, the originals of which are in the possession of the general passenger agent, excepting the copies of the two great paintings, "The White Man's Fancy" and "The Red Man's Fact."

In this little book he has undertaken to tell visitors to the great cataract how to see the numerous points of interest in the most convenient and satisfactory manner and with the least expense.

By following the itinerary there suggested, one whose time is limited can cover all the most prominent features of Niagara in a two days' visit, though from ten days to two weeks could be profitably spent in this pursuit.

A valuable feature of the book is a new relief map, showing the entire course of the Niagara river, from Lake Erie to Lake Ontario, including a bird's-eye view of Buffalo, Tonawanda, Niagara Falls, Suspension Bridge, Lewiston, Niagara-on-the-Lake, Youngstown and Toronto. This map is beautifully printed in four colors, so arranged as to give a most excellent idea of locations and routes. No one who visits this ever wonderful scene should be without this book, and a copy of it can be had for two 2 cent stamps sent to the general passenger agent of the New York Central.

MASTER MECHANICS' ASSOCIATION. Report of the proceedings of the Twenty-ninth Annual Convention, held at Saratoga, N. Y., June 1896. Standard size, 6 x 9 in.

The twenty-ninth volume of the proceedings of the American Railway Master Mechanics' Association has just been received from the secretary, Mr. John W. Cloud. The binding is half leather, and is uniform with the proceedings of the Master Car Builders' Association. This volume opens with a list of officers for the year 1896-'97, followed by a list of the committees and the subjects assigned to them for report at the convention of next year. The usual list of members with their addresses and the constitution and by laws is then given. The rest of the work, consisting of 365 pages is devoted to the proceedings of the last convention and an index of the contents of the volume. Nearly all of the reports and the discussions thereof have been published by abstract in the columns of this journal. The volume closes with a list of the names of the past presidents. The letter press is excellent and the illustration, as a rule are clear and are of sufficient size to permit of reading the dimensions conveniently. The members of this association are like those of the Master Car Builders' Association, to be congratulated upon the improvement in the proceedings which will make the volumes uniform and will permit of their being placed at once in a library without the necessity of binding them for this purpose. The publication of these two volumes within three months after the convention is evidence of remarkably rapid work by the secretary and the appearance of the volumes is decidedly creditable to him.

CHICAGO MAIN DRAINAGE CHANNEL. A description of the machinery used and methods of work adopted in excavating the twenty-eight mile drainage canal from Chicago to Lockport, Ill. By Charles Shattuck Hill, C. E., associate editor Engineering News. Reprinted from Engineering News, with much additional matter. With 100 illustrations and an index. pp., 130, cloth, price $1.50. New York, The Engineering News Publishing Company, 1896.

This book gives a complete history and an excellent series of descriptions of the great enterprise of the Chicago

main drainage canal The book gives a history of the inauguration of the work and maps showing the location and alignment, after which a general description is taken up and comparisons are made between this and other large projects of similar character. The third chapter is devoted to specifications, after which the different divisions of the canal are treated separately,and particular attention is given upon each division to the special features of the work and the machinery employed in handling it. A chapter is devoted to the regulating works, and this is accompanied by two large lithographed plates of the details of this part of the construction. The closing chapters treat of miscellaneous construction, administration and a discussion of the entire undertaking in the form of a summary of the more salient features of the work which might otherwise be lost sight of in detailed description. There are two appendices, the first of which illustrates the earth conveyor, a special dump car and the Warrington steam shovel in use on section "A." The second appendix treats of the effect of the drainage canal on the level of the great lakes. A good index is provided. The feature of the book which will be most valuable to engineers is the careful attention which is given to the cost of different parts of the construction and excavation, the text being accompanied by a large number of tables of prices. The letter press and binding are excellent and the illustrations are specially good. The work presents data and descriptions of engineering construction which is in many respects novel and one of its greatest values lies in the fact that it appears in time to render the information of assistance in similar operations of the present day. Engineers who have collected data concerning this undertaking will find this work useful on account of its convenience, its clearness and practical character. The work is exceedingly creditable to the author.

The Universal Construction Co. of Chicago has published a 44 page pamphlet illustrating the steel cars designed and built at the works of the company in Chicago, and also the Harvey steel car, the patent rights in which have recently been acquired by that concern, is pictured in various types. The text accompanying the illustrations contains a number of statements with reference to steel car construction and quotations from remarks on this subject by prominent mechanical officers, both in this country and abroad. The special claims of these manufacturers are clearly stated and arguments presented favoring the introduction of this class of rolling stock.

TECHNICAL MEETINGS.

The Engineers' Club of Philadelphia meets on the first and third Saturdays in each month, at 8 p. m., at the house of the club, 1122 Girard street, Philadelphia, Pa.

The Civil Engineers' Club of Cleveland, meets on the second and fourth Tuesdays in each month, at 8 p. m., at the Case Library building, Cleveland, Ohio.

The Association of Engineers of Virginia, holds its in formal meetings on the third Wednesday of each month from September to May inclusive, at 8 p. m., at 710 Terry building, Roanoke, Va.

The Western Railway Club of Chicago, holds its meeting on the third Tuesday of each month.

The Central Railway Club meets on the second Friday of January, March, May, September and October, at 2 p. m., at the Hotel Iroquois, Buffalo, N. Y.

The Denver Society of Civil Engineers meets on the second and fourth Tuesdays in each month except July, August and December, when they are held on the second Tuesday only, at 36 Jacobson building, Denver, Colo.

The Western Society of Engineers holds its regular meetings for the transaction of business and the reading and discussion of papers on the first Wednesday of each month except January.

The American Society of Civil Engineers holds meetings on the first and third Wednesdays in each month, at 8 p.m., at the House of the Society, 127 East Twenty-third street New York City.

The Association of Civil Engineers of Cornell University meets weekly every Friday, from October to May inclusive, at 2:30 p. m., at Lincoln Hall, New York.

The Boston Society of Civil Engineers, meets monthly on the third Wednesday in each month, at 7:30 p. m., at Wesleyan Hall, 36 Bromfield street, Boston, Mass.

The Canadian Society of Civil Engineers meets every other Thursday at 8 p. m., at 112 Mansfield street, Montreal, P. Q.

The Foundrymen's Association meets monthly on the first Wednesday of each month, at the Manufacturers' Club, Philadelphia, Pa.

The Montana Society of Civil Engineers meets monthly on the third Saturday in each mouth, at 7:30 p. m., at Helena, Mont.

The New England Railroad Club meets on the second Tuesday of each month, at Wesleyan Hall, Bromfield street, Boston, Mass.

The New York Railroad Club has a monthly meeting on the third Thursday in each month, at 8 p. m., at 12 West thirty-first street, New York City.

The Northwestern Track and Bridge Association meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m., at the St. Paul Union Station, St. Paul, Minn.

North-West Railway Club meets alternately at the West Hotel, Minneapolis, and the Ryan House, St. Paul, on the second Tuesday of each month.

The Engineering Association of the South meets on the second Thursday of each month at 8 p. m., at the Cumberland Publishing House, Nashville, Tenn.

The Railway Signaling Club holds its meetings in Chicago, Ill., on the second Tuesday of January, March, May, September and November. G. M. Basford, secretary, 818 The Rookery.

The Southern & Southwestern Railway Club holds its meetings on the third Thursday of January, April, August and November, at the Kimball House, Atlanta, Ga.

The Western Foundrymen's Association holds its meetings on the third Wednesday in each month, at the Great Northern Hotel, Chicago, Ill.; secretary, S. T.Johnstone, 1522 Monadnock building.

The Technical Society of the Pacific Coast has a monthly meeting on the first Friday in each month at 8 p. m., at the Academy of Sciences building, 819 Market street, San Francisco, Cal.

The Engineers' Club of Cincinnati has a monthly meeting on the third Thursday in each month, at 7:30 p. m. at he Literary Club, 24 West Fourth street, Cincinnati, O. Address P. O. Box 333.

The Engineers' Club of Minneapolis holds its meetings on the first Thursday in each month, at Public Library building, Minneapolis, Minn.

OUR PATENT RECORD.

(Our record of patents that most interest our readers is compiled regularly by our Washington correspondent with the idea of being a complete index. Space forbids more than the citing of a reference, but the complete specification or drawing of any patent desired will be mailed to any address upon receipt of 10 cents in stamps, and other information in regard to patents will be cheerfully given. Address all communications to our correspondent, Edw. C. Weaver. Attorney and Counsellor, McGill Building, Washington, D. C.)

567,972, ventilator and dust arrestor for railway cars,Samuel H. Gehlman, Springfield, Ill., filed July 21, 1896. Serial No. 600,046 (no model).

567,998, rail joint,Thomas C. du Pont, Johnstown, Pa., filed June 2, 1896. Serial No. 594,021 (no model).

568,019, locomotive engine, Isaac T. Dyer, Chicago, Ill., assignor, by direct and mesne assignments, to the Dyer Power Co., same place, filed May 13, 1895. Serial No. 549,046 (no model).

568,051, automatic gate for railway crossings, Leland L. Summers, Chicago, Ill., filed February 13, 1895. Serial No. 538,254 (no model).

568,065, brake for wheels of railway cars, Edward Cliff, Newark, N. J., filed April 13, 1896. Serial No. 587,264 (no model).

568,072, car buffer, Willard F. Richards, Buffalo, N. Y., assignor to the Gould Coupler Co., New York,N. Y.,filed June 27, 1896. Serial No. 597,111 (no model).

568,079, car truck, Walter S. Adams, Philadelphia, Pa., assignor to John A. Brill, same place, filed April 16, 1896. Serial No. 587,783 (no model).

568,166, railroad car, Jos. A. Miller, Providence, R. I., filed May 16, 1894. Serial No. 511,393 (no model).

568,173, rail fastener, Jas. M. Spaulding, Syracuse, N. Y., assignor to Helen E. Spaulding, same place, filed April 17, 1895. Serial No. 587,958 (no model).

568.182, grain door car, George H. Treadgold and John E. Mills, Port Huron, Mich., filed Oct. 21, 1895. Serial No. 566,331 (no model).

568,183, grain car door, Geo. H. Treadgold and John E. Mills, Port Huron, Mich., filed Dec. 9, 1895. Serial No. 571,498 (no model).

568.226, brake shoe, Eugene W. Applegate, New York, N. Y., assignor to J. B Turbell, Corning, N.Y., filed June 8, 1896. Serial No. 594,776 (no model).

568,218, railway signaling apparatus, Theo. W. Stueber, Parsons, Kas., filed June 27, 1896. Serial No. 597,234 (no model).

26,068, car seat panel, John A. Brill, Philadelphia, Pa., filed Feb. 26, 1896. Serial No. 580,909. Term of patent 14 years (design).

PERSONAL.

Mr. F. P. Graff has been appointed receiver of the Ohio Southern road, vice Mr. J. R. Megrue, resigned.

Mr. C. C. Collins has been appointed acting general freight agent of the Columbus, Sandusky & Hocking, vice Mr. D. E. McMillan until a permanent successor is appointed.

Mr. F. Husted, superintendent of the Cincinnati, Hamilton & Dayton road, has resigned, and will go with the Baltimore & Ohio Oct. 1.

Mr. Sam C. Ray, formerly passenger agent of the Queen & Crescent, has been tendered and accepted a similar position with the Mexican National R. Co., which runs from Laredo,Tex., to the City of Mexico.

Mr. John Irwin, another Wabash Railway official, has been appointed trainmaster of the Grand Trunk Railway system, with headquarters at Belleville. His district will extend from Toronto to Brockville.

Mr. P. T. Bancroft, who lately resigned the position of foreman in the Columbus, Sandusky & Hocking shops at Columbus, has been appointed general foreman of machinery at the shops of the Chicago, Rock Island & Pacific.

Mr. D. E. McMillan, who was last April made general freight agent of the Columbus, Sandusky & Hocking, has tendered his resignation, to take effect immediately, and will enter the coal business with Mr. J. W. Ellsworth, with headquarters at Cleveland.

Mr. H. N. Freer has been appointed chief clerk in the division freight office of the Norfolk & Western to succeed Mr. A. J. Bandy, whose resignation is announced. Mr. Freer is a brother of Mr. G. M. Freer, traveling freight agent of the Cleveland, Akron & Columbus, and is a present rate clerk in the freight office of the Queen & Crescent at Cincinnati.

Mr. A. N. Gray, whom Mr. W. W. Finley appointed as his chief clerk when third vice president of the Great Northern, has been formally appointed to the same position under Mr. W. H. Newman, successor to Mr. Finley. Mr. Gray has had a wide experience in four different departments of railroading and has proved himself to be a valuable assistant.

At a special meeting of the board of directors of the Gulf, Colorado & Santa Fe Railway, the following officers were elected: L. J. Polk and F. M. Gilbough, directors, vice B. F. Yoakum and Thomas J. Jackson, resigned. Paul Morton was elected third vice president vice B. F. Yoakum, resigned. H. C. Whitehead was elected general auditor, vice W. R. Gillett, resigned.

Mr. J. B. Walsh, general yardmaster of the Chicago & Eastern Illinois, has resigned. He has been on that road nineteen years, commencing as a clerk in the superintendent's office. He has in that time held the positions of fireman, engineer, conductor and yardmaster, filling all with ability. Mr. N. B. Danberger, at present in charge of the company's yards at Brazil, will succeed Mr. Walsh.

The Northern Pacific Beneficial Association at its recent annual meeting elected Mr. M. C. Kimberly,general superintendent of the Northern Pacific, as president, succeeding Mr. W. G. Pearce, formerly assistant general manager of the Northern Pacific, who tendered his resignation on account of his removal to Tacoma, where he has assumed the duties of assistant general superintendent of the Northern Pacific. All the other officers were re-elected.

Mr. J. R. McGregor, who has been appointed southern passenger agent of the Cincinnati, Hamilton & Dayton, to succeed Mr. W. A. Wiggins, will assume the duties of that position on October 1. Mr. McGregor worked under Col. Edwards when the latter was general passenger agent of the Queen & Crescent and was then located at Birmingham, Ala. Recently he has been with a Florida road. It has not been decided as yet where Mr. McGregor's headquarters will be.

A circular has been issued by General Superintendent Shields of the Chicago Great Western which reads as follows. "Mr. C. M. Jordan is hereby appointed agent of this company at Kansas City, Mo., with offices at 7 West Ninth street. He will have charge of the company's business at Kansas City, Mo., and Kansas City, Kas., and will have complete jurisdiction over all employes of the company in the cities named, except employes of the mechanical an maintenance of way departments".

Mr. H. G. C. Ketchum, C. E., known in connection with the Chignecto Ship Railway, Nova Scotia, died very suddenly on the afternoon of the 8th inst., from heart disease. Deceased was born in Frederickton and was 57 years of age. He was educated at King's College, now the University of New Brunswick, at Fredrickton. Of late years he devoted all his energy to the carrying out of the Ship Railway and he died just as he was advocating the claims of the work before the new dominion government.

Col. Horace Porter, who recently resigned the position of vice president of the Pullman Co. to assume the active management of the St. Louis & San Francisco road, has held that position and had charge of the company's office in New York city for nearly twenty years. It has been rumored that the company was about to close its New York office, and the general impression is that the two vice presidencies will be consolidated under the charge of Mr. T. H. Wickes, now second vice president.

Mr. E. C. Minetree, general agent of the Southern Railway in Florida, in charge of the freight department, with offices in Jacksonville, Fla., died suddenly on the train Friday night while on his way from that city to Boydton, Va., where he intended to visit his family. Mr. Minetree had been in Jacksonville but a short time, having assumed the duties of general agent in July last. Previous to that time he was stationed at Norfolk, Va. He had been troubled with consumption for some time, but considered that he was strong enough to visit his family, as he intended to take up a residence at Jacksonville on October 1. His death was sudden and unexpected.

Owing to the resignation of Mr. W. H. Newman as third vice president of the Chicago & Northwestern, a number of other changes are about to be made. Among them the following are reported: Mr. H. R. McCullough, now general freight agent, will probably be made general traffic manager, in charge of both freight and passenger business, the position being a new one on the Northwestern; Mr. J. T. Clark, at present general freight agent of the Chicago, St. Paul, Minneapolis & Omaha road, is slated as Mr. McCullough's successor, and Assistant General Freight Agent Marvin Hughitt, Jr., will go to the Omaha line to succeed Mr. Clark.

Mr. Charles E. Levy, president of the New Orleans & Western Railway, has tendered his resignation to that company, as owing to poor health, he is making an extended trip in Europe. His resignation was accepted with the sincere regrets of the entire board. Mr. W. Mason Smith, the vice president, was chosen to fill the vacant position, and Mr. W.W. Pierce was elected vice president. Mr. Smith is one of the largest cotton buyers in New Orleans and occupies a decidedly important position among cotton men. Mr. Pierce is the inventor of the celebrated Pierce hydraulic cotton press which is used at Port Chalmette and which enables the road to deliver cotton to the ships at a minimum density of 30 lbs. to the cubic foot.

Mr. Wm. Gibson, superintendent of the Cincinnati, Columbus & Sandusky division of the Big Four, has been appointed assistant general manager of the Baltimore & Ohio Railroad. Mr. Gibson was connected with the Queen & Crescent for several years, and then retired from rail-

roading to engage in mercantile pursuits. He entered railroad service again under Trainmaster Bruce of the Cincinnati, Hamilton & Dayton, leaving that road to take service with the Hocking Valley, under Superintendent Charles Rockwell. He left the Hocking Valley to take service with the Big Four as chief clerk to General Manager Greene, and when Joseph Ramsey, Jr., succeeded Mr. Greene as general manager he remained with the Big Four as Mr. Ramsey's chief clerk. Mr. Ramsey appointed Mr. Gibson division superintendent of the Big Four, which position he has since filled. No successor to Mr. Gibson has yet been appointed, but report says that Mr. P. J. English, at present trainmaster of the road, will be selected to fill the vacancy.

Hon. James F. Joy so well known in railroad circles both as a promoter and manager of railroads, died at his home in Detroit, Mich., on the 24th inst. of heart dicease, aged 86 years. James F. Joy was born in Durham, N. Y., Dec. 20. 1810. His father was a manufacturer of edged tools. After being educated in the public schools he became a teacher, saved his money, entered and graduated from Dartmouth college. He then went to Sambridge law school, a became a protege of Judges Story and Greenleaf. He was afterwards instructor in Latin in Dartmouth college. He came to Detroit in 1836 and entered the law office of United States Senator Porter. In 1837 he was admitted to the Detroit bar. Almost from the first he was employed in the most important cases in the state and national courts, in which his clear, commanding intellect and powerful reasoning generally gave him victory. He induced eastern capital to extend the Michigan Central to Chicago, and to build the Chicago, Burlington & Quincy road. He was mainly instrumental in extending the road. into Indian territory. In 1865 he became president of the Michigan Central and gridironed the state with what is now known as the Michigan Central Railroad system. Vanderbilt cast a longing eye on it, and bought a majority of the shares from New England shareholders. This caused Joy to retire, but his magnificent business abilities were immediately sought by the Wabash, and he became president of that system. Through all his business career he was a scholar, and his library contains the best editions of the French, English, Latin and Greek classics, as well as works of Tyndall, Huxley, Spencer, and the great French writers on speculative thought. Though long past the scriptural age he suffered no decrease in his mental powers and his physical strength until recently was remarkable.

RAILWAY NEWS.

Chicago & Northern Pacific.—It is reported that the notices of the sale of the Northern Pacific under a decree by Judge Jenkins will shortly be issued, as all claims and counter claims between that road, the Northern Pacific and the Wisconsin Central have been amicably settled. It is stated that a plan of re-organization has been practically perfected. H. W. Bishop, master in chancery of the circuit court of the northern district of Illinois will sell the property. The sale will take place from the steps of the Cook county court house at such time as Mr. Bishop may appoint. In the selection of the day of sale Mr. Bishop will be governed by the wishes of the reorganization committee. The road must bring $10,000,000, the purchaser in addition assuming two mortgages, one to the city of Chicago for $650,000 and the other to Edwin A. Abbott and John A. Stewart for $394,000, together with minor obligations.

Chicago, Indiana & Eastern.—This road, which was projected from Converse southeast to Richmond, Ind., 79 miles, and which was completed from Fairmount to Matthews last year has suspended all traffic and operation of the road indefinitely, as it is claimed it has been running at a loss. The property is in the hands of a receiver, Mr. G. B. Swetzer, of Wabash, and he has asked for a court order to effect a sale of the rolling stock to pay labor claims, and the transfer of the roadbed to liquidate a large sum due Chicago parties for material furnished.

Columbia & Red Mountain.—Tracklaying has begun on the Columbia & Red Mountain road. This line is an extension of the Spokane Falls & Northern, and runs from Northport, Stevens county, Wash., to Rossland, B. C.—a distance of about 15 miles. Work is expected to be completed by November 1. The construction bas been quite heavy, as the country is mountainous, necessitating heavy grades and curves. The bridging however is light, with the exception of the Columbia river, which will require a bridge 1,200 ft. in length. This will be constructed during the coming winter, transfer across the river in the meantime being by ferry. The name of the seven miles below the boundary line is as above, while that part lying north of the boundary in British Columbia is known as simply Red Mountain R. Mr. E. J. Roberts, of Spokane, is chief engineer.

Columbia & Western.—This company is now operating between Trail and Rossland, on the southern border of British America, and is building handsome general offices near the smelter at Trail. As soon as the building is finished the head office will be removed from Rossland and the road will be operated from Trail. It was expected to continue the line west of Rossland this year, but the secretary, Mr. A. P. Heinze, who went to London, Eng., some time ago for the purpose of floating bonds, has not been heard from recently, and it is not known whether he has been successful or not. The season has now advanced so far that even if he should raise the money the work will hardly commence before next spring. The line as now operated is 11.16 miles long. Mr. F. A. Heinze, of Butte, Mont., is president.

Gulf & Ship Island.—Now that this road is completed into Hattiesburg, plans are being made to develop to its fullest capacity the resources of the country through which it passes. As yet the road has not secured the deep water outlet wanted at Gulfport, but the road is completed to the pine woods of Mississippi, and vast quantities of this lumber is now being prepared for market. It is the intention of the Gulf & Ship Island R. to have it loaded at Gulfport by means of smaller draft boats, lighters, etc., but before the company can arrange to get the right kind of rates from the ocean transportation people they want to have some kind of an opportunity of bringing into the timber section a cargo of freight, so that one trip will not be an entire loss. It is understood that the Gulf & Ship Island people have made such arrangements as will enable the fruit merchants of New Orleans to have their fruits brought north in large quantities. This railroad has recently been released from the receivership, and is is now in first class condition. The Bradford Construction Co., a large concern in the east, has entire charge of the road for a number of years, and it is the purpose of the company to have the road constructed into the interior as quickly as possible, as through that means only it hopes to be able to realize upon the investment already made in building the mileage at present operated. The Bradford Construction Co. becomes interested in this road by virtue of it having secured the contract for the first building. The line went into receiver's hands, and then the company went to work to protect itself by getting charge. It is said that the line will be completed from its present terminal at Gulfport to Ship Island by the Bradford Construction Co., and that work upon this extension will be started some time soon. When this is done the Ship Island road will have deep water and a prospect of entering into active competition with the other harbors along the coast. This can only be accomplished, however, when the road has also gained connection in the north with some through line to eastern cities, and this the construction company proposes to secure as soon as possible by further road building in that direction. Col. Tom Hale, of Hattiesburg, is traffic manager, and is trying to prove to the fruit dealers of New Orleans that consignments should be sent north by that route.

Hoxie, Pocahontas & Northern.—Grading on the Hoxie, Pocahontas & Northern is progressing rapidly and connection with the Iron Mountain at Hoxie is being made this week. The latter road will bring track material for the construction company and the work of laying ties and rails will begin as early as October 1. Railroad labor is reported in demand by the contractors in charge of the work.

Indianapolis, Chattanooga & Chicago.—After the completion of about 12 miles of this road in Owen county, a meeting of the directors was held and it was unanimously agreed to defer further operations until after election. The line is to connect the cities named in the title.

Kansas City & Omaha.—Articles of incorporation have been filed with the secretary of state of Nebraska by the Kansas City & Omaha Railway Co. The new company which is a reorganization of the Kansas City & Omaha Railroad Co., proposes to run its lines from Fairfield, Clay county, its principal place of business. It is a Union Pacific project and is 170 miles long. The capital stock is $3,000,000, separated into shares of $100 each, and the limit of indebtedness is $2,000,000.

Kaslo & Slocan.—This is a road something over 20 miles in length which was built in the Kootenay country, British Columbia, last year. Mr. D. J. Munn, New Westminster, B. C., is president of the line and is quoted in a western paper as saying: "Since the road has been opened for business it has stimulated activity in the development of mines all along the line. There are now in the neighborhood of 50 shipping properties. Many of them are small as yet, and the proceeds are used in working the property. There does not seem to be the least sign of disappointing features in any of the mines as yet. The road has carried out 9,000 tons of ore since first opened up, the average value being about $120 per ton."

Knoxville, Cumberland Cap & Louisville.—On Sept. 19, a suit brought by the Knoxville, Cumberland Gap & Louisville to recover $225,000, the amount voted to said road in bonds by the city, of Knoxville, was terminated in favor of the city, after six years litigation. Upon completion of the line the city claimed that the road had not met its contracts and refused to issue the bonds. The railroad brought suit in the chancery court, and won. An appeal was made to the supreme court, which directed in favor of the railroad company, as it had the stock ready to issue, and the clerk and master was directed to ascertain this fact. He reported in favor of the railroad. Since that time the chancery court of appeals has been established. The case was argued before this court about a year ago. While the suit was pending the railroad offered to compromise for the principal, deducting about $50,000 and interest. The city refused the proposition and won the case by an opinion rendered by Judge J. M. Barton, of Chattanooga. It will now go to the supreme court for confirmation or reversal.

Norfolk & Western.—A rumor is afloat to the effect that after the affairs of the Norfolk & Western are settled and the reorganization completed, an extension will be built to the Clinch Valley division from St. Paul over the graded line of the old "Three C's" to connect with that line at Johnson City, Tenn

Philadelphia & Reading.—The motion asked for by W. W. Kurtz and other bondholders of the Philadelphia & Reading R. Co. to enjoin the managers of the company from executing the decree of the foreclosure sale of the Philadelphia & Reading R. property was refused by Judge Acheson of the United States court, and the sale was held on Wednesday, September 23, as had been previously announced. The property, which was sold subject to the general mortgage, was divided into three parcels, with a par value of $42,785,173.85. The first parcel was knocked down to Mr. Coster for $7,500,000; the second parcel, which was to secure obligations amounting to $12,500,000, went to the same man for a like amount, while the third parcel was also bought by Mr. Coster for $1,000,000. Prior to the sale of the third parcel counsel for Mrs. Green entered a protest against the sale of the property. Mr. Coster deposited with the auctioneer three checks of $100,000 each, drawn by J. Piermont Morgan & Co., to bind the sale.

Portland & Rumford Falls.—A branch of the Portland & Rumford Falls road from Canton to Otis Falls, via Peterson's Rips, is being constructed in order that through log trains may be handled from the timber lands on the line of the Rangeley Lakes road to the mills at Peterson's and Otis Falls.

Richmond, Nicholasville, Irvine & Beattyville.—This small road with a large name will be offered at public auction in Versailles, Ky., on Saturday, Oct. 10, by order of the United States circuit court, to foreclose a mortgage held by the Central Trust Co., of New York. This is the second attempt to dispose of the road, there being no bidders on June 9, when first offered. As the upset price since then has been reduced from $500,000 to $250,000, it is believed that a sale will be made this time. The R. N. I. & B. road extends from Versailles to Irvine, in Estill county, a distance of 61 miles, and all the grading is completed for the extension to Beattyville, 20 miles further, in the coal region. The road has been in operation to Irvine for six years and has been in the hands of a receiver for five years.

Rumford Falls & Rangeley Lakes—The Rumford Falls & Rangeley Lakes R., was opened for traffic through to Bemis about June 1, and passenger trains have since that time been running through to that point. Since the close of the fiscal year the company has succeeded in purchasing all the outstanding stock of the Rumford Falls & Buckfield R., and arrangements are now being made to take absolute title of the road. The result for the operation of the road for the year are said to be very gratifying, inasmuch as there has been a steady increase in the receipts and a general degree of prosperity all along the line of the road. The road-bed has been steadily improved by ballast and ditching. One and one-half miles of 70 lb. steel rails have been placed in the track, also 17 automatic switches. Of new track 9,247 ft. has been built using 15,557 ties mostly of cedar. One new locomotive and 25 flat cars, all of standard pattern, have been purchased. The policy of making general improvements have been continued.

Sebasticook & Moosehead.—Work on the extension to the Sebasticook & Moosehead, which was discontinued for want of funds, is about to begin if reports are true, as the new part of the road is said to have passed into the hands of the Canadian Pacific R., and that not only will all the workmen be paid at once, but operations will be pushed vigorously until cold weather makes further work for the winter impossible. The present line is eight miles in length running southeast from Hartland and connecting with the Maine Central at Pittsfield.

Southern Pacific.—Argument was begun in the United States court at Los Angeles, Cal., on Sept. 18, in the suit brought by the government against the Southern Pacific Railway to recover 4,000,000 acres of land adjoining its road along the Colorado river. Attorney J. H. Call, for the government, made the proceedings sensational by charging fraud on the part of the Southern Pacific Co., claiming that it had changed the map of the preliminary surveys to represent operations on the final maps. The railroad's attorney had produced papers to show incompetency on the part of Mr. Call. Mr. Call made a statement that the Southern Pacific Railroad was attempting to run the interior department of the government, and the interior department was attempting to run the department of justice towards its own ends. Judge Ross before whom the argument was held sustained Mr. Call and denied the railroad attorney the right to present affidavits.

NEW ROADS AND PROJECTS.

Canada.—A project is afloat to build a railway from Lethbridge to Nelson, through the Crow's Nest pass, and it is thought that by next spring the actual work of construction will be well under way. It is believed that the Dominion government will render substantial aid to the Canadian Pacific, by whom the enterprise is to be carried out. The government realizes that if the Dominion is to benefit from the mining development in British Columbia, the Kootenay country must be tapped by a Canadian road. The loan will probably exceed $5,000,000, the amount which the conservative element has asked parliament to loan.

Colorado.—Articles of incorporation for the Denver South Park & Hill Top road have been filed at Denver with the secretary of state. The road will eventually become a part of the Denver, Leadville & Gunnison or "South Park" line. It extends from Fairplay seven miles west to Hill Top where it taps a tumber of shipping mines. The incorporators are Thomas F. Dunaway, Frank Trumbull, B. H. DuBois, S. L. Rainey and Felix Leavick, all officers of the Union Pacific, Denver & Gulf which operates the Denver, Leadville & Gunnison. Capital stock $100,000.

Kentucky—It is said that an effort will soon be made to secure a railroad to the immense cannel coal fields of Morgan county, Ky., by a route through the mountains of Elliott county from the present terminus of the Eastern Kentucky at Webbville. A route is already proposed from Morehead to these coal fields, and the distance by either

route is about the same. The objective point in both cases is Walnut Grove.

Mexico.—Press dispatches from the City of Mexico under date of September 18, contain the following: Engineers of the Mexican Central R. have completed the work of the location of the new branch of that railway from Jiminez to Parral as far as Eloro, and the government has approved plans for the first 20 kilometers. Regarding the Laguna branch of the same railway, the track has been laid for a distance of 26 kilometers from Lerdo and trains are running from that point to Sacramento. Nothing definite has been done regarding the projected branch to Batopilas. A study of the project is now being made by a competent engineer to ascertain what amount of traffic is probable.

Minnesota.—Articles of incorporation were filed at the state capitol at St. Paul, Minn., on the afternoon of Sept. 24 for the Duluth, Superior & Western R. Co., $1,525 being paid to the secretary of state for same. The incorporation is said to be bona fide and the road will run from Duluth to some point not yet named on the Red River of the North, presumably Winnipeg. Whether the company is to purchase the Duluth & Winnipeg or become its rival is not known. The amount of capital stock named in the articles is $3,000,000.

Pennsylvania.—Valuable franchises have been obtained in the Beaver Valley section by the board of incorporators of the North Shore R. (mention of which was made last week) and all sorts of conjecture and rumors are flying about as to who is back of the project. Most of the indications seem to point to the Pittsburgh & Lake Erie, which at present has no connection with the towns on the east side of the Beaver and Ohio rivers. In the vicinity of Rochester a new bridge is being constructed and the new line could in this manner connect with the Pittsburgh & Lake Erie, and would undoubtedly prove a great feeder, drawing its traffic from the factories of New Brighton and Rochester, and the many potteries which are scattered all over that section. It is said that the Pennsylvania Co. has determined to fight the proposed road, and has already thrown many stumbling blocks in the way. As the latter road owns most of the land along the river banks and controls the facilities of practically the entire section, it is difficult to see how they can be defeated. One thing is certain that the new road will not be completed without a bitter struggle, and the reported utterances of people connected with the new enterprise to the effect that it will be completed and in operation before June, 1898, in spite of the Pennsylvania Co.'s position, is doubted by many.

Washington.—A few months ago a preliminary survey was made for a new railroad from Pe Ell, Lewis county, to the Columbia river, and the feasibility of the undertaking was demonstrated. Last week, accompanied by a crew of fifteen men, Mr. Ellsbury, of Centralia started a more thorough survey of the proposed line. The object of the line is to bring the product of the Centralia coal mines to the seaboard, so that vessels may be coaled without going to the Sound. The location of the coal bunkers would be at some point on the Columbia opposite Astoria. The distance would probably be less than 40 miles.

INDUSTRIAL NOTES.

Cars and Locomotives.

—The Great Northern Railway is building 50 cinder cars at its own shops.

—It now seems certain that the Baldwin Locomotive Works has secured a contract for the building of eight locomotives for use on the Imperial Railway of China. At the office of the firm it was stated that the order, which is for four freight and four passenger engines, was only a sample order, and that these locomotives would be the first from the works ever introduced into China. Work will not begin upon these engines for some days, awaiting further advices from China.

—The Elliott Car Company of Gadsden, Ala., which is building 100 flat and 200 box cars for the Florida East Coast Railway, has delivered the first installment of flat cars. The cars are fitted with every modern convenience. Each car is provided with an air brake and is constructed after the most approved methods.

—The Big Four railway shops in Wabash, Ind., which employ nearly 200 men and have been running eight hours a day and part of the time only seven hours for the last year has commenced running ten hours. The increase of hours is due to the demands for repairs to rolling stock.

Bridges.

—Three new steel bridges are being constructed by the railroad company east of Truckee, Cal., two of them being over the Truckee river and one over Prosser creek. Five miles of new steel 75 pound rails have also been laid and more will be laid soon.

—At a meeting of the South Brooklyn Board of Trade on the evening of Oct. 2, the question of building a bridge from the Battery, New York, to Governor's Island, N. Y. H., and from there to South Brooklyn, will be discussed.

—The contract for the highway bridge near Elliott, Pa., has been awarded to Nelson & Buchanan, Chambersburg, Pa. There will be one span 216 feet long.

—The free bridge commission has closed contract with the Groton Bridge & Manufacturing Co. of Groton, N.Y., at $353,022 for the construction of a free bridge across the Arkansas river at Little Rock.

—The Pennsylvania Company, operating the Pittsburgh & Erie, is about completing a new steel bridge across the Allegheny river at Warren. The wooden structure is one of the oldest on the Pennsylvania lines, and is the last one on that division, the company having expended a good deal of money the last two years in renewal of bridges on that division.

—The Hocking Valley will soon begin the construction of a new bridge at Logan, Ohio.

—Nelson & Buchanan of Chambersburg, Pa., have been awarded the contract at about $10,200 for a one-span iron bridge over Conodoguinet creek, Geremyer's Mill, Pa.

—In connection with the recent visit of the Chinese ambassador, Li Hung Chang, and his remarks as to the desirability of railway extension in China, it may be of interest to state that a large quantity of steel bridgework was shipped the week before last from Glasgow for the imperial railways of North China for a new line of about 90 miles, from Tientsin to Pekin. The whole work is under the specification and inspection of Sir Benjamin Baker, K.G., I.E., consulting engineer in Great Britian for the Chinese government.

—The grand jury has ordered the construction of a bridge between Ellwood City, Pa., and Hazel Dell. The bridge will be 450 ft. long and 79 ft. high. It is said that work will be commenced this fall.

—The county board of freeholders, Paterson, N. J., has resolved to build a Melan bridge on the Paterson and Hamburg turnpike. Specifications and plans are being made by the Melan Arch Construction Co., 71 Broadway, N. Y., and bids will shortly be asked for.

—The construction of a new wagon bridge over St. Albans bay at Excelsior, Minn., is being discussed by the county commissioners. The county engineer has been directed to make a survey.

—The secretary of war has issued an order granting the Kansas City, Osceola & Southern Railroad Co. the right to construct a bridge over the Osage river at Osceola, Mo.

Buildings.

At a recent meeting of the East River Bridge Commission, the plans for the foundations of the New York tower of the new bridge were adopted. The secretary was authorized to advertise for bids for the work. The bids will be opened on or about October 7, and a bond will be required from the successful bidder for $125,000 for the faithful performance of the work. The specifications which were also approved, provide that the contractor begin work on the tower within ten days after the awarding of the contract, and finish within fourteen months. The foundation on the New York side will be laid at Delancy street and the East River, and at South Sixth street, in Brooklyn. The towers will be of masonry set in caissons, the dimensions being for the New York tower caission 60 ft. by 76 ft. and for Brooklyn 63 ft. by 79 ft., and they will be of such hight when sunk that their tops will be, in New York 38 ft., and in Brooklyn 47 ft. below high water mark. The towers will be of granite to the water line, and below that limestone may be used to a depth of 4 ft. below the line. Below that granite or Kingston limestone may be used. The copings and facings must be of granite.

—The residents of Gravesend Beach and South Bensonhurst (Brooklyn, N.Y.,) are to have a bill presented to the next legislature authorizing the construction of a drawbridge over Coney Island creek at Harway avenue. The committee of Kings and Queens counties has decided to build a bascule bridge over Newtown creek at Vernon avenue.

—The Philadelphia & Reading is making plans for a new steel and stone bridge at the falls of Schuykill.

—Bids are asked for constructing a new bridge at Jackson street, Newark, N J., over the Passaic river. The bridge will have three piers in the river and a draw 225 ft long; estimated cost $100,000.

—The Philadelphia capitalists who are desirous of building a street railway from Hartford to connect with Springfield, have received plans for a new iron bridge over the Connecticut, which the company propose to build, if granted a franchise in the latter city.

—The Michigan Central Railway Company, Mich., will expend $160,000 in the new junction shops at Jackson, Mich. Every kind of improved machinery used in repairs and car shop will be installed.

—The Ann Arbor Railroad has officially announced that it will occupy its new terminals at Seneca and Cherry streets, Toledo, about October 1, prox. After that date all its Toledo local freight and passenger business will be transacted on that property. The general offices of the company will be located on the second floor of the new passenger station building.

—The Choctaw, Oklahoma & Gulf Railway has just signed a contract with F. R. McGinnis for the construction of a new shop plant at Shawnee, O. T., which comprises a machine shop building 100x280 ft.; office building, storeroom, wood shop, paint shop, boiler house, oil house, with improved cinder pits and water service for shop and fire purposes, together with the laying of about three miles of rail for the yard.

—The Flint & Pere Marquette shops at East Saginaw, Mich., will be remodeled, and new machinery to the value of $40,000 installed to facilitate the rapid manufacture of cars.

—The Hendey Machine Company, Torrington, Conn., has placed a contract for a new factory building. It will be of brick and heavy timber construction, or what is termed the "slow burning construction". The size will be 45x153 ft., three stories high, with a tower five stories high. The tower is intended for stairways, elevator closets, and on top story a water tank for sprinklers. The different floors will be one room only on each floor. This building will be used exclusively for the building of our Hendey-Norton lathes. There will be no material change in the present factory and its machinery.

Iron and Steel.

—The subjoined statement of a test of cast steel manufactured by the Sargent Co. is very good evidence that first class open hearth cast steel is being made in the city of Chicago and a refutation of some of the claims which have been made that it is necessary to go east to obtain satisfactory steel castings:

PHYSICAL PROPERTIES OPEN HEARTH STEEL.

Heat No.	Tensile Strength per Sq. In.	Per Cent Elongation in 8 In.	Reduct'n of Area
E 138 . . .	67,800	22.5	41.5
E 141 . . .	60,200	24.8	46.6
E 142 . . .	64,700	23.3	44.7
E 144 . . .	59,300	24.8	46.9
E 149 . . .	60,500	26.2	45.4
E 154 . . .	62,200	25.5	52.5

—The big Edgar Thomson steel works of the Carnegie Steel Co. resumed operations in all departments September 20. The plant gives employment to 3,000 men, who have been idle two weeks. The company has already booked enough orders to keep the plant in operation two weeks. Before the end of the month enough orders will be received to keep the mill busy until after election, when a big boom is expected. Six of the company's blast furnaces are in operation and another is nearly ready to blow in. Two more are being relined and improved for an early start.

—The Birmingham Car Wheel Works has put in additional machinery for the manufacture of tramcar wheels.

—The nut and bolt works of Plumb, Benedict & Barnard at North Tonawanda, N. Y., resumed work recently with a full force of 400 men.

—The Indiana Steel Casting Co. of Montpelier, Ind., which, as was noticed last week, passed into the hands of receivers, was forced to the wall by a mechanic's lien of $13,500 held by a Cleveland firm who furnished the machinery. Montpelier citizens gave a bonus of $20,000 for the location of the plant.

—A telegram from Birmingham, Ala., under date of September 17 says: Final tests of the Hawkins process of steel making were made to-day at the Jefferson steel plant, and they were satisfactory. Chemists, steel and iron men and metallurgists from Chicago and other points who have been here almost a fortnight watching the practical operations of the process say that steel can be manufactured with the iron of this district at a cost of several dollars less than it can be turned out in Pennsylvania, Ohio or Illinois. The Tennessee Coal, Iron & Railroad Co. and the Sloss Iron & Steel Co. are making a low silicon iron here at a cost less than $6 per ton. F. W. Hawkins of Detroit, Mich., the patentee of the process, has been here for the last two months in charge of the demonstrations. The Jefferson steel plant is being placed in good condition for regular steel making.

—The Gibson Iron Works of Gibson City, Ill., has been leased and will be put in operation in a short time.

—After a shut down of nine days 3,000 men have resumed work at the Cambria mills at Johnstown, Pa. General Manager Price states that the steel works, open hearth blooming mill No. 1, the rail mill and three blast furnaces are the departments which have resumed. At the time of the shut down it was announced that the slump in business was only temporary and that early resumption was expected.

Machinery and Tools.

—Thomas Carlin's Sons of Allegheny, Pa., are shipping a part of the Roane (later Buffalo) Iron Works of Chattanooga, Tenn., to their works at Allegheny, two car loads being lately received. This material consists of large shears, cold saws, straightening presses, rail drill presses, etc., etc., which will be put in first class order and then be placed on the market.

—The American Stoker Company of Dayton, O., has recently perfected a steam motor which is applied to each stoker, thus making each machine independent. This renders the work of installation very simple. It also renders the stoker practicable for use under marine boilers. This company is desirous of a general representation through engineering firms handling pumps, heaters and boiler room supplies and invites correspondence from interested parties.

—The Moore Manufacturing Co., Manufacturers of Moore's anti-friction differential chain hoists, hand power cranes, winches, etc., Milwaukee, announces that it has purchased the entire block department of the Moore Manufacturing & Foundry Co.—merchandise, machinery, tools, patterns, etc.,—and will hereafter make a specialty of the manufacture of portable hoisting machinery. The business is controlled by the individual patents of E. Y. Moore, the vice president of the company. The officers as founders and managers of the Moore Manufacturing & Foundry Co., built up a large business which they conducted for many years, and they hope to continue and extend the trade of the old company. The new company has on hand a large stock of chain hoists. Specifications for special hoisting machinery, cranes, etc., will receive prompt attention.

—The Fountain Machine Co. of Cincinnati, Ohio, has been incorporated with a capital of $50,000. The company will manufacture and sell hot air engines, gas engines and gasoline engines, and do a general business in manufacturing, dealing in and repairing engines.